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A REVISION OF THE SPATHIINAE OF THE OLD WORLD (HYMENOPTERA, BRACONIDAE)

By G. E. J. Nixon, B.A., F.R.E.S.
(*Imperial Institute of Entomology.*)

Manuscript received 27.ii.1942.

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With One Plate and 283 Figures in the Text.

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Introduction.

I. *Material studied and acknowledgements.*

I undertook this revision in 1937, partly because I felt that I could best contribute to our knowledge of the Braconidae by attempting large-scale revisionary work and partly because the Spathiinae, being of economic importance, were in particular need of systematic overhauling.

The amount of material accessible to me at that time in the British Museum was small; apart from the species in the named collection, it consisted almost entirely of series of specimens sent to the Imperial Institute of Entomology for identification.

It seemed as though the work could soon be completed, for, with one or two exceptions, appeals to continental sources for material met with disappointing results; either no insects at all could be produced or just the European species, amounting to some half dozen, were sent. It was only after I wrote to Dr. C. F. W. Muesebeck of the United States Bureau of Entomology to see if perhaps he could make any contribution, that the extent of the task I had set myself took on very much larger proportions. Dr. Muesebeck was kind enough to arrange with the authorities of the United States National Museum that the Spathiinae collected by the late C. F. Baker in Borneo and the Philippines should be sent to me for study.

This magnificent collection, containing about a thousand insects, showed me that I had had no more than a glimpse of the subfamily I was proposing to work out. It forms the essential basis of this revision, and, incidentally,

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it changed what had promised to be but a light excursion into the domain of systematics into a veritable pilgrimage.

To all those who have helped me to complete this piece of work by lending me material, I offer my grateful thanks; they are: Monsieur L. Berland of the Museum d'Histoire Naturelle, Paris; Dr. J. G. Betrem, Java; Dr. H. Bischoff of the Zoologisches Museum, Berlin; Dr. J. C. M. Gardner of the Forest Research Institute, Dehra Dun, India; Dr. B. M. Hobby of the Hope Department, Oxford; Dr. C. F. W. Muesebeck of the United States Bureau of Entomology, Washington, D.C.; Monsieur A. d'Orchymont of the Musée Royal d'Histoire Naturelle, Brussels; Dr. Hans Sachtleben of the Deutsches Entomologisches Institut, Berlin; Prof. E. Titschack of the Hamburgisches Zoologisches Museum u. Institut, Hamburg, and finally, Dr. S. L. Tuxen of the Universitetets Zoologiske Museum, Copenhagen.

I am also indebted to the Trustees of the British Museum (Natural History) for a grant which made it possible for me to include drawings by Miss Margaret Mackay and Mr. Engel Terzi.

II. *General remarks.*

It should be pointed out that this revision is based primarily on a study of the female of the species. The males tend to be smaller than the females and their specific characters are less emphasised. More often than not, their smaller size is accompanied by a lack of sculptural definition and a fading out of whatever colour pattern might have existed in the female. Hence, unless bred series are available, the association of the sexes in material taken at random in the field is always risky. And again, the males frequently show a confusing sexual dimorphism in that the first large segment of the abdomen can be sculptured, while in the female it will be quite smooth.

Very little work has been done on the SPATHIINAE, and what there is consists chiefly of descriptions of odd species. A notable exception is Wilkinson's revision of the Indo-australian and Ethiopian species (1931a). He recognised twenty-six species. The other contributors to our knowledge of the subfamily have numbered among them, Szepligeti, Cameron, and Enderlein. Of the descriptions made by these authors, those of Szepligeti are easily the worst. It can be said of Cameron that he did at least try to give a full descriptive picture of his species. But he was handicapped by having no access to large named collections. Perhaps something of the same kind could be said of Enderlein, though it is hard to estimate the value of his work. In his chief contribution to the study of the SPATHIINAE (Zur Kenntnis der Spathiinen und einiger verwandter Gruppen, 1912), it is possible to detect an over-confidence which at first impresses but later disappoints the reader. This paper of his, together with Wilkinson's, will be criticised in the general discussion of the subfamily.

At times it has seemed almost impossible to reduce the mass of material I have had before me to some kind of orderly arrangement. To accommodate it there existed virtually only one described genus—*Spathius*—as I shall subsequently show. But the limits of *Spathius* were so wide that they could cover a great diversity of form. The purely practical question arose therefore as to how the relationships between the numerous species were to be expressed. The decision was between the use of the species-group concept and the creation of a large number of genera. I decided in favour of the former, being guided by two considerations: (1) that the characters on which I relied in determining what groups of species were closely related to each other were peculiar to the female only and (2) that these groups of species, although striking enough when their most typical members were alone taken into acount, were rarely clearly definable. There was always the odd species for which an arbitrary decision had to be made. I have found it necessary to describe only four new genera.

Some of the new species I have described, amounting to 167, will certainly fall later as synonyms. But this can happen only when there again exists an opportunity of examining the types scattered among the various museums of Europe. The original descriptions of all the species I have been unable to recognise are given in full in the appendix.

For the purpose of this revision it has not been possible to study the SPATHIINAE as an isolated unit, and some discussion of genera in my opinion wrongly associated with this subfamily has been necessary. They are dealt with in a separate section. In several instances I have sought to give emphasis to my remarks about them by means of figures. It is hoped that they will prove useful to students who may wish to study these little known genera at some time in the future.

III. *Geographical distribution.*

My remarks on the subject of the geographical distribution of the subfamily are tentative and must be accepted only with due regard to three important considerations, (1) that the SPATHIINAE, being insects of small size and of obscure habits, are extremely likely to have been overlooked even in those regions where collecting of all orders of insects has been extensive, for example, on the African continent; (2) that the possibility of accidental introduction is always present because of the parasitism of the subfamily on wood-boring beetles, and (3) that the amount of material on which I have based my conclusions is relatively small. Thus, while it is possible to give some idea of the range of distribution, it may be that my observations on the abundance of species in any particular region will not correspond with actual fact.

It seems that the SPATHIINAE, as defined in this work, have spread over almost the entire globe, with the possible exception of South America. Their headquarters appear to be in the Malay Archipelago as represented by Malaya (Singapore), Borneo and the Philippine islands, and it is here, I think, that the ancestral stock, or some branch of it, must have been influenced by environmental factors favourable to abundant proliferation. A far larger concentration of species is found in this part of the world, among them many compact groups of closely allied species, than in any other. On the other hand, the individual species tend to be very restricted in range. I have found that species which occur in Malaya (Singapore) frequently occur also in Borneo (Sandakan), but only rarely do they appear, too, in the Philippines (*Spathius epaphus* sp. n.). *Spathius colophon* sp. n., very closely allied to *epaphus*, occurs in Borneo and Malaya and also in the Philippine island of Palawan; but in Butuan, Mindanao, it is represented by a distinct geographical race. A few species have a wide distribution in the Philippines, occurring in Mindanao in the south and Luzon in the north. Generally speaking, however, it seems that the majority of the Philippine forms are restricted in range, being often confined to one island (I make this last statement with reserve because the number of specimens of each species I have studied has been invariably small).

I am acquainted with no species from either the Moluccas or Celebes. From the Aru Islands one species is known, *Spathius ruficeps* Smith. It occurs in identical form in the Philippines, but in Borneo and Java is represented by a different race.

New Guinea is apparently poor in species; they amount to no more than a dozen or so but are of considerable interest. They have no close affinity with the Malayan, Bornean and Philippine fauna, but curiously enough, one species, *Spathius japenensis* sp. n., from Japen I., Dutch New Guinea, is extremely closely related to the Indian *Spathius cavillator* Wilkinson. The *arcesius* group of *Spathius* has one of its two representatives in New Guinea and the other in N. Queensland, Australia. Another *Spathius* group of two species, that of *cassidorus* sp. n., has one member in the Cyclops Mts. of Dutch New Guinea and one in the Solomon Islands.

The subfamily is almost absent from Australia, only three species so far having been obtained there. Of these it is safe to say that one is probably endemic, the apterous *Spathius turneri* sp. n., from the Tambourine Mountains, S.E. Queensland. Only one species has been found in New Zealand, also wingless, *Metaspathius apterus* Brues; it is not known to me in nature (see p. 189).

India likewise has a poor Spathiine fauna, but incidentally it is the one country where the economic importance of the subfamily is being thoroughly investigated (Krishna Ayyar, 1941). It serves as the western outpost of the most widely spread species of *Spathius* of the Indo-australian region: *Spathius apicalis* Westwood, which has a range extending from India (previously under the name of *festinans* Wilkinson) through the Andamans, Malaya and Java to China, Formosa, and the Philippines, and possibly Queensland, Australia. No SPATHIINAE have so far been found in Burma or Indo-China but doubtless the subfamily is represented in these two countries.

The Ethiopian region and Madagascar: About twenty species, distributed among three genera, are known to me from the Ethiopian region but I think this number can hardly be representative. With the exception of *Platyspathius pictipennis* Viereck and *Spathius opis* sp. n., all the species are endemic, though the genera and even species-groups to which they belong have a much wider distribution. For example, *Platyspathius* Viereck extends from Africa through India to Malay and the Philippines, while *Spathius rusticulus* Wilkinson, and *Spathius dissors* Wilkinson, the former with one close ally in Africa, the latter with none, both belong to groups which are represented by many species in the Malay Archipelago. Madagascar has so far produced only four species, three of them endemic.

The Palearctic region has an exceedingly poor Spathiine fauna. I have been able to recognise six species, all falling within the same species-group of the genus *Spathius*. They appear to have a wide distribution. One of them, the apterous *Spathius pedestris* Wesmael, has been found in places as far apart as Madeira and Denmark. It is interesting to notice that the only other species known from Madeira, *Spathius moderabilis* Wilkinson, seems to be confined to that island. The palearctic species-group of *Spathius* is represented outside Europe and the Mediterranean region by an Indian species, *Spathius generosus* Wilkinson, which is very closely related to the common European *Spathius exarator* L. According to Watanabe (1937), this last mentioned insect has a range extending to Japan.

IV. *Biology*.

With a single exception, the SPATHIINAE, so far as is known, are parasitic on wood-boring beetles, but there seems to be very little known about their life-history beyond the mere association of some species with their host. However, the gap in our knowledge has to some extent been filled by an excellent and detailed account of the life-cycle of one species by Krishna Ayyar (1940).

He studied *Spathius critolaus* Nixon to find out what use could be made of this parasite in the control of the cotton-stem weevil, *Pempherulus affinis* Faust, a serious pest of cotton in South India. The account he gives may be summarised as follows :—

Spathius critolaus is an external, solitary parasite of the older grubs of *Pempherulus.* As well as in cotton, it will attack this host in *Triumfetta rhomboidea, Sida acuta, Corchorus olitarius, Hibiscus esculentus, Hibiscus ficulneus* and *Malvastrum coromandelianum.* It is found less frequently parasitising the weevil-borer of *Amaranthus* (*Hypolixus truncatulus* Fab.), and the Bostrychid (*Sinoxylon sudanicum* Lèsne) which infests Cambodia cotton stalks. Also, it has been reared artificially on *Bruchus theobromae* L.

After a preoviposition period which varies from 7 to 10 days, the female seeks out the weevil-grub, produces paralysis by stinging it and lays an egg at random on the surface of the body. Oviposition is more frequent at night and takes from 10 to 30 minutes to complete. The species can be parthenogenetic but unmated females lay fewer eggs than mated females, an average of 23 eggs compared with 38 eggs. In one to two days the egg hatches and the larva at once begins to suck the juices of the host. Its final position is apparently always on the lateral or ventral surface of the weevil-grub. In from 3 to 8 days it is full grown and it then spins a white silken cocoon near the dried-up remains of its victim. The pupal period varies from 7 to 10 days, being on the average a little shorter for males than for females. The total life-cycle covers 13 to 18 days and the adult parasite can live for as long as 162 days.

The larva appears to be like that of the typical Ichneumonoid ectoparasite and except that in its last two stages it is more swollen in the middle, Krishna Ayyar found little differentiation among the four larval stadia. The early stages are described in detail.

Krishna Ayyar discusses the potentialities of *Spathius critolaus* as a possible control-measure. He found that the incidence of parasitism in the field is low, never rising above 1%. In spite of this, however, he seems to think that the habits of *critolaus* show certain characteristics which, if the fullest advantages were taken of them, might render it a more effective check to *Pempherulus.*

The same author and Narayanaswami (1940) have also studied the biology of *Spathius vulnificus* Wilkinson and discussed its effectiveness as a means of controlling this pest of cotton. Under natural conditions *vulnificus* commonly parasitises *Dinoderus* (BOSTRYCHIDAE) in bamboo (*Dendrocalamus strictus*), (Beeson and Chatterjee, 1935) and, although a probable parasite of other borers such as Lyctids and Cerambycids, has not been known to parasite weevils in a state of nature. Ayyar and Narayanaswami found that it would breed successfully in both *Pempherulus* and *Hypolixus* grubs but they have so far not had opportunities for testing its efficiency in the field.

The life-history of *vulnificus* is apparently very similar to that of *critolaus* but it is a gregarious parasite, laying a group of eggs on the host larva, all of which can develop. The rate of mortality was found to be high, only 32·5% of the eggs laid eventually producing adult wasps. A possible explanation of this heavy mortality, as suggested by Krishna Ayyar and Narayanaswami, is insufficiency of food, due to a lack of balance between the gregarious habit of the parasite and the size of the host. I am not aware that there are any data to show what happens when *vulnificus* parasitises its normal hosts, namely, species of *Dinoderus*. The life-cycle covers 19–29 days in the case of the Curculionid hosts. Krishna Ayyar and Narayanaswami have not been able to produce any evidence that parthenogenesis is a regular feature of this *Spathius*; they found that eggs laid by unmated females did not develop.

Spathius fuscipennis Ashmead, a species unknown to me, appears to provide a striking exception to the range of hosts attacked by the Spathiinae. It is a parasite of the lepidopteron *Chilo simplex* Butler, in the Philippines and has been introduced into Japan (Ishii, 1930, and Ishii & Mizutani, 1934) for the purpose of controlling this pest of rice in that country.

Generic and Specific Characters and Terminology.

Head: Throughout the subfamily, the head is of very generalised form; it is usually decidedly transverse but sometimes approaches a subcubical condition; its shape, as seen from above, is rarely of specific value but the extent to which it is narrower behind the eyes than across them is of group-specific importance. The Face is defined as that part between the clypeus and the antennal insertions; in a few species-groups of *Spathius*, its sculpture is highly specialised (*vulnificus* and *rusticulus* groups) but on the whole it is monotonously uniform and its value as a specific character is almost negligible. Antenna: this is considered to consist of three parts, namely, scape, pedicel and flagellum (fig. 1); except in the new genus *Paraspathius*, the scape is always unmodified though it varies within small limits in length; some use can be made of the length of the 1st flagellar segment in proportion to the combined lengths of scape and pedicel; the hairs of the flagellum are of some importance in *Spathius* (groups of *fasciatus* and *alipes*). The Frons is defined as that part between the antennal insertions and a line which joins the eyes and touches the anterior edge of the median ocellus; it is nearly always transversely striated and rarely shows specific characters. Vertex: the presence or absence of sculpture on the vertex is of great importance as an aid to the defining of species-groups in *Spathius* but rarely are characters of specific importance found here; the vertex is never obviously punctate, except to some extent in *Paraspathius* gen. n.; when sculpture is present it usually takes the form of aciculation or striation in varying degrees of strength; the striation, when strong, may sometimes be very much wrinkled and come to resemble rugose-reticulation (especially in *Spathius*, species-group *fasciatus*) but rarely is the

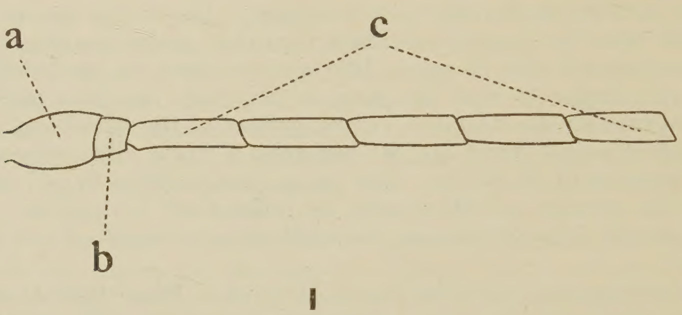

Fig. 1.—Antenna of *Spathius*: (a) scape; (b) pedicel; (c) flagellum (part).

transverse direction of the sculpture obscured; alternatively, the sculpture, as in *Platyspathius* Viereck (not a true member of the SPATHIINAE), may consist of fine scaly-reticulation without a trace of transverse elements.

Thorax: On the whole the shape of the thorax offers little of value, either generically or specifically with, however, a few notable exceptions; on the other hand, the individual sclerites are of the greatest importance; in a lateral view, the thorax appears to provide good specific differences in *Platyspathius* and the *dissors*, *rusticulus*-groups of *Spathius*; in the *labdacus* group of *Spathius*, compression takes places dorso-ventrally; the degree in which this modification occurs is of specific importance. The Pronotum, on the whole very uniform in appearance, provides a character of which I have made much use both for defining species and groups of species in *Spathius*; the dorsal surface of the pronotum—sometimes referred to here as the collar—is provided with a conspicuous keel, the lateral prolongations of which extend downwards on to the sides and form the antero-ventral boundary of a more or less specialised area which I have designated by the non-committal name " lateral area " of the pronotum (figs. 2–4); the position of the keel, referred to throughout as the " pronotal keel ", varies in relation to the posterior margin of the pronotum; sometimes it is widely separated from this, as for example in the group of *imbecillus* in *Spathius* but more often it is fused with it medially; in a great many cases (sections of *Spathius*, and *Platyspathius*) it is virtually not developed at all; the " lateral area " is of little value and it is mentioned only because in a few species, the most notable examples of which are the two species included in the *vesevus*-group of *Spathius*, it is not defined. The Mesonotum is of the greatest importance for the identification of species and of species-groups; seen from the side, it may slope gradually to the pronotum or fall more or less vertically to this; usually the slope remains constant in a group of species but

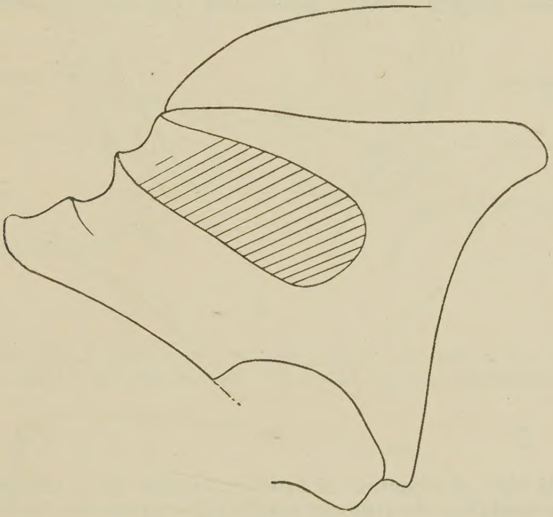

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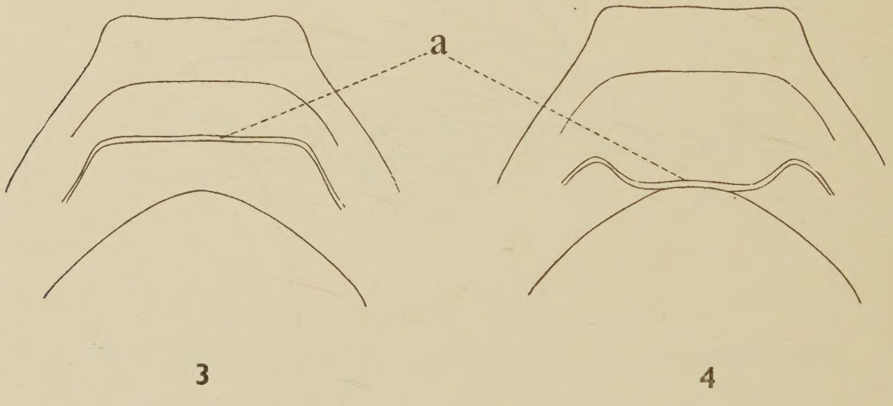
FIG. 2.—Side of pronotum of *Spathius*, to show the " lateral area " (cross-hatched).

sometimes it is a means of separating the species themselves as in the *rusticulus* and *dissors*-groups of *Spathius*; the vestiture of the mesonotum usually consists of long outstanding hairs; very rarely, as in *Paraspathius dindymus* sp. n. and the *tityrus*-group of *Spathius*, does it consist of fine close pubescence; the thickness of the vestiture, whether it is pubescence or outstanding hairs, remains, with very few exceptions, very constant; the sculpture of the mesonotum is of the greatest importance; it has no generic value (to some extent perhaps in *Paraspathius*) but provides specific characters in *Spathius*; the basic sculpture of the lobes consists of scaly-reticulation, the meshes of which are more often than not broken and ill defined; raised sculpture if present consists almost always of transverse rugosity, the individual ridges, whether straight or wrinkly, being lateral prolongations of the costae of the notaulices; the notaulices posteriorly are almost always margined on their inner side by a stout keel (referred to in this work as the "posterior carinae" of the mesonotum); sometimes these carinae present specific characters in so far that they may be very sharply defined, or on the other hand lose their emphasis and be lost in the surrounding rugosities. The Scutellum is very uniform in appearance, and is of no value generically, and of but little specifically; in some of the apterous forms of *Spathius* (*apotanus* Wilkinson and *apterus* Wesmael), it may be feebly conically raised; in *Platyspathius* it varies among the species in the degree to which it may be convex. Except in *Platyspathius* where, seen from the side, it may show as a feeble dentiform projection, the Postscutellum is uniform throughout the entire subfamily and has no systematic value; on the other hand, its pubescence, if present, may have some specific significance. Propodeum: this shows a basic arrangement of carinae and areas as is shown in fig. 5; the longitudinal medial keel is referred to as the "basal carina"; it bifurcates at apex, and its two prongs are called the "forks" of the basal carina; the basal carina varies in relation to the length of its forks, and some use of this relationship is made in attempts to define groups of very closely allied species (for example: the *dolopes* subgroup of the *fasciatus* group of *Spathius*); the large, usually five-sided (when clearly defined) area on each side of the basal carina is referred to as the "dorsal area" of the propodeum: the sculpture of these areas may help towards specific identification, but on the whole it is



FIGS. 3–4.—Dorsal view of pronotum of *Spathius* to show the "pronotal keel" (a); in fig. 3 it is separated from the posterior margin of the pronotum, in 4 fused with it.

unreliable as is the sculpture of the propodeum generally; what I call the length of the propodeum is defined in fig. 6. Mesopleura: three parts are referred to, namely, the furrow, the disc and the subalar impression (fig. 7); the last of these is the usually more or less depressed area beneath the wing insertions; very occasionally it seems to have some specific value; the disc is of the greatest

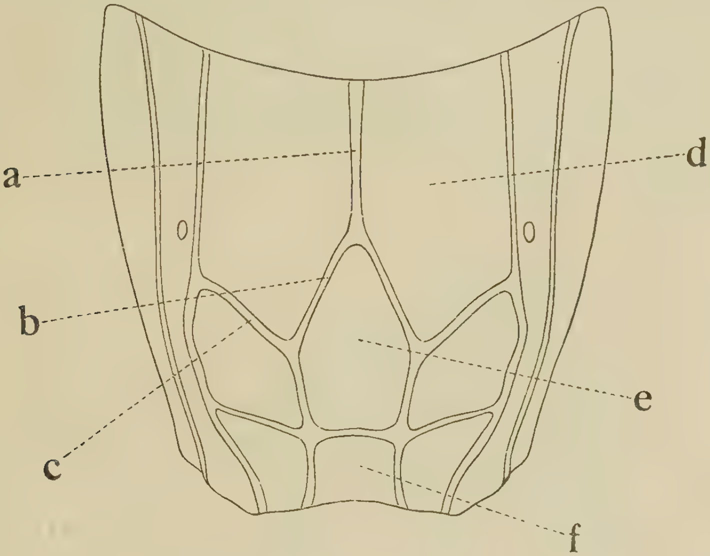


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FIG. 5.—Propodeum of *Spathius*: (a) basal carina; (b) fork of the basal carina; (c) costula; (d) dorsal area; (e) areola; (f) area petiolaris.

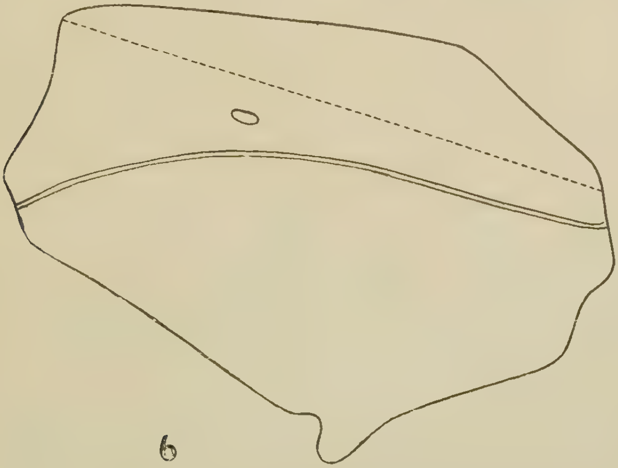

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FIG. 6.—Lateral view of propodeum (including metapleura) of *Spathius* to define what is meant by its length (shown by dotted line).

importance both in the determination of species-groups and of species in *Spathius*; it is usually smooth and shining, but sometimes may be deeply scored by strong sulcation; it never shows an obviously punctate surface. Legs: the presence or absence of a dentiform projection at the base of the hind coxa has been found to have no generic value; in some groups of *Spathius* (*imbecillus*-group and *ruficeps*-group) its absence is constant; but in many other groups it varies in degree of development even among closely related species; the femora present no peculiarities within the subfamily except that they may be considerably swollen; the vestiture of the hind tibia—it can be assumed that the vestiture of the other pairs of tibiae is the same—is often of great importance interspecifically; only the hairs of the dorsal surface are taken into account, and these are measured in relation to the middle width of the tibia, when this is seen from the side; for the identification of species it is important that the length of these hairs be carefully appreciated; the apical rim of the hind tibia is a little produced on its outer side and this produced part is referred to as the "apical lobe"; whereas the apical lobe of the front and middle tibiae is always provided with a row of spines, that of the hind pair may or may not have spines; although these spines are often difficult to see, their presence or absence is of great importance in determining species and species-groups of *Spathius*; the proportions of the segments of the hind tarsus, *i.e.*, 1 in relation to 2 and 3 in relation to 5, rarely have specific value but are often of considerable group-specific significance in *Spathius*; in *Pseudospathius*, the length of the segments

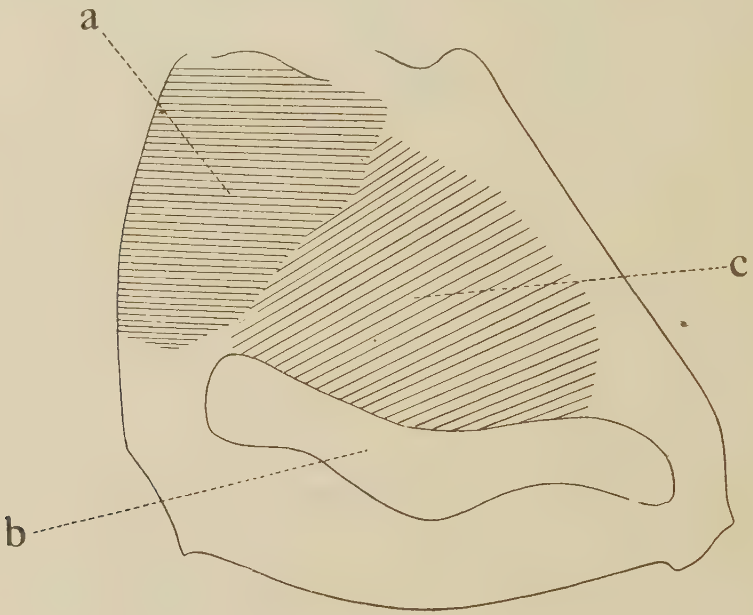

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FIG. 7.—Mesopleura of *Spathius*: (a) "subalar impression"; (b) mesopleural furrow; (c) disc of mesopleura.

of the hind tarsus appears to be important generically; the colour of the hind legs has been used extensively, and of particular importance is whether the tibia has a pale, more or less colourless area at base; in most species of *Spathius* such as area exists but it is often obscured because the rest of the tibia is almost equally pale; in descriptions only the colour of the hind legs (coxae excepted) is mentioned with very rare exceptions (*Spathius*, group of *cassidorus* for example); their colour may be regarded as determinative for that of the other two pairs of legs, except that it is usually more diffuse in these latter and markings are much less distinct.

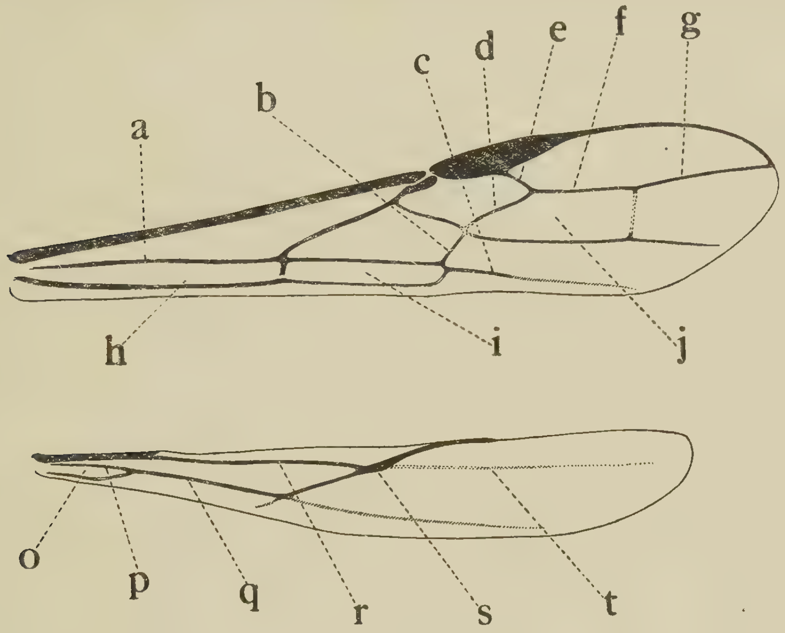

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Fig. 8.—*Spathius testaceitarsis* Cameron, ♀, wings: Fore-wing:—(a) medius; (b) recurrens; (c) nervus parallelus; (d) 1st intercubitus; (e), (f) and (g) 1st, 2nd and 3rd abscissae (respectively) of the radius; (h) submedian cell; (i) 2nd discoidal cell; (j) 2nd cubital cell. Hind-wing:—(o) submediellan cell; (p) and (q) 1st and 2nd abscissae of the mediella; (r) and (s) 1st and 2nd abscissae of the subcostella; (t) radiella.

are much less distinct. Wings: for terms employed see fig. 8; the venation is remarkably constant throughout the whole subfamily; only in the *Platyspathius* group of genera can use be made of it generically; very slight variations in the arrangement of the veins take place in *Spathius*, the wings thereby acquiring a subtle but distinctive facies; the point at which the recurrens enters the 2nd cubital cell and the nervus parallelus leaves the 2nd discoidal cell is important, often for the determination of closely allied species; the variation of the hind-wing varies hardly at all; there are slight differences in its shape and the shape of the mediellan cell but no specific value appears to exist here;

the 2nd abscissa of the subcostella, *i.e.*, that part of the vein beyond the apex of the mediellan cell, may be thickened in some males (*Paraspathius* and the *alipes*-group of *Spathius*) and come to resemble a false stigma; its value in these cases seems to be specific.

Abdomen: this always consists of two sharply differentiated parts, each of which I prefer to designate by a different name; the elongated first tergite I refer to as the petiole, a term in general use by hymenopterists for the same part; the remainder of the abdomen, consisting of 6 discrete dorsal segments (7 tergites), I call the " gaster "; the term gaster is used in a similar sense by myrmecologists; the 1st segment of the gaster consists of the fused 2nd and 3rd tergites as is the rule in the BRACONIDAE; in *Spathius* there is no suture to mark the separation but in *Platyspathius* a furrow is present which probably corresponds to such a suture; in all cases, however, I refer to the 1st segment of the gaster, irrespective of whether any demarcation of its component parts exists, as tergite (2 + 3); it is hoped thereby that a source of confusion very common in the writings of some of the older writers will be avoided. The petiole rarely shows specific characters; it varies considerably in length but its shape usually remains fairly constant within a genus or species-group. Of the greatest importance is the sculpture, if present, and to a less extent, the shape of the gaster; in *Spathius* the sculpture may have specific, but more often has group-specific, value; for the correct use of the key to the species-groups of *Spathius*, it is essential to appreciate the degree of development of the lateral, *differentiated* margin which frequently occurs on tergite (2 + 3) and less often on tergites 4 and 5; often these tergites are very sharply deflexed laterally and appear to have such a margin but in such cases no thickened ridge will be seen as is characteristic of the truly differentiated margin. The epipleura of the tergites is in this work defined as that part of the tergites ventral to the spiracles; where a lateral margin exists, the epipleura is of course sharply differentiated and in such cases are usually thin and membranous with a sculpture different from that of the dorsum of the tergite; usually, however, there is no suture between them and the dorsal surface of the tergites.

Size is very rarely of any value as a specific character; even within species it varies considerably.

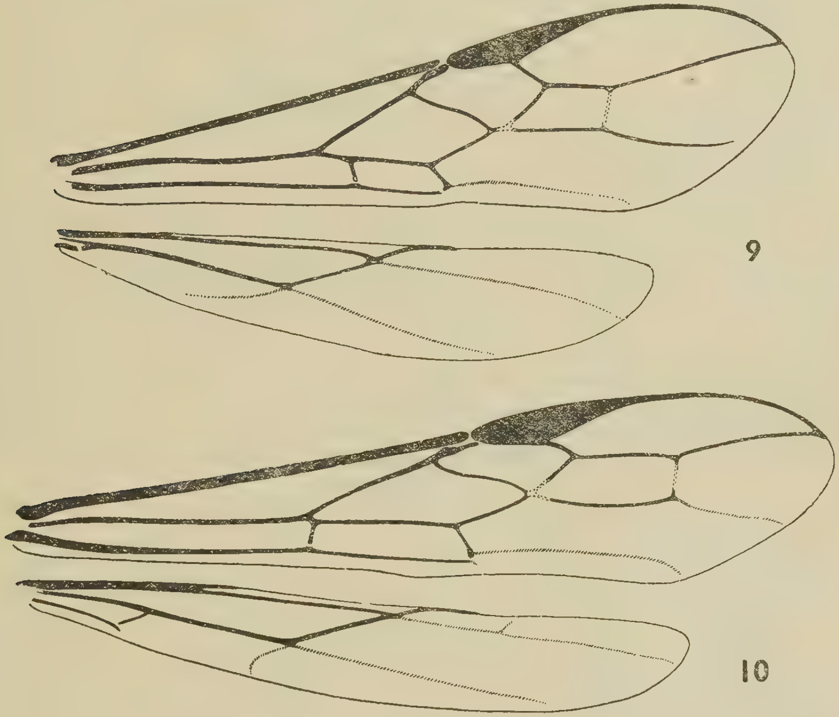
DIAGNOSIS AND DISCUSSION OF THE SPATHIINAE.

SPATHIINAE.

1862, EUSPATHIOIDAE Förster, *Verh. Nat. preuss. Rheinl.* **19** : 236.
1885, SPATHIINAE Marshall, *Trans. ent. Soc. Lond.* **1885** : 60.
1900, Spathiini Ashmead, *Trans. U.S. nat. Mus.* **23** : 141.
1924, Spathiini Handlirsch, *in* Schröder, *Handb. Ent.* **3** : 749.
1927, SPATHIINAE Hellén, *Acta Soc. Fauna Flora Fenn.* **56** : 49.
1930, Spathiini Fahringer, *Opusc. Bracon.* **3** : 61.

Head always of generalised form, transverse but sometimes approaching a subcubical condition. Maxillary palpi 5-segmented; labial palpi 4-segmented. Except in *Paraspathius* gen. n., the antennal scape always of simple form; segment 1 of the flagellum almost always at least a little longer than segment 2, never shorter. Ocelli in a triangle which is either equilateral or has the base longer than the sides; the base is never shorter than the sides.

Thorax on the whole very generalised in form, rarely compressed dorso-ventrally (*Spathius, labdacus*-group); more often considerably elongated. Pronotum variable in length, of simple form except that it may possess a transverse keel; only in one species (*Spathius ochus* sp. n.) is the pronotum transversely swollen; such a swollen condition is common among Doryctine genera. Mesonotum almost always with clearly defined notaulices; vestiture of the mesonotum consisting usually of sparse outstanding hairs but sometimes in the form of fine close pubescence; rarely are the hairs virtually absent. Scutellum always of simple form, sometimes a little convex and in rare instances (*Spathius apotanus* Wilkinson), conically raised. Postscutellum rarely in profile surmounted by a small dentiform projection. Propodeum with a basic arrangement of keels as shown in fig. 5; frequently the carination is much reduced and the only keels which remain more or less clearly defined are the two longitudinal ones which enclose the spiracles. Legs: hind coxa with or without a dentiform projection beneath at base; femora of simple form except that the hind pair may be short and swollen (*Paraspathius, Platyspathius* ♂♂ and *Spathius*, group of *labdacus*); front tibiae always spinose along their dorso-lateral side, the spines, especially in small species, often very difficult to make out; inner apical rim of the hind tibia always with at least a double fringe of fine silky hairs (except in *Platyspathius* and allied genera); hairs of the upper surface of the hind tibia almost always long, sparse and outstanding; in any case, never forming a dense close vestiture; segments of the tarsi always of simple form but varying in their proportions. Wings rarely vestigial; fore-wing always with three cubital cells; with a single exception (*Toka* gen. n.), the recurrens either more or less interstitial or, as is almost always the case, received into the base of the 2nd cubital cell; nervus parallelus issuing from the distal side of the 2nd discoidal cell always at least slightly above the middle, usually very obviously so; submediellan cell of the hind-wing always short, the 1st abscissa of the mediella always shorter than the 2nd (about $\frac{2}{3}$ as long); subcostellan cell of the hind-wing always of considerable width, at least apically.



Figs. 9–10.—Wings of:—9. *Biphymaphorus auranteiceps* Cameron, ♀; 10. *Leptospathius formosus* Szepligeti, ♀.

Abdomen petiolate, the petiole (except in *Platyspathius* Viereck, *Toka* and *Parana* gen. n., which are not true SPATHIINAE and are included in the present work only for the sake of convenience) always with a distinct, though sometimes rather feeble, abrupt apical dilatation, never gradually widened from spiracles to apex (except in the genera just mentioned and the aberrant genus, *Sisupala* n.); the sides of the petiole never form a continuous line with the sides of tergite (2 + 3); except in the four genera just mentioned, the epipleura of the petiole never extend forwards more than half-way. Tergite (2 + 3) except in *Pseudospathius* Szepligeti and *Platyspathius* Viereck, always without a transverse suture indicating the separation of the two component parts; never a trace of oblique furrows on this segment such as occur in the Doryctine genus *Leptospathius* Szepligeti, nor of longitudinal lateral furrows such as are shown by the Doryctine genus *Biphymaphorus* Szepligeti; frequently tergite (2 + 3) and sometimes 4 and 5 with a completely differentiated lateral margin.

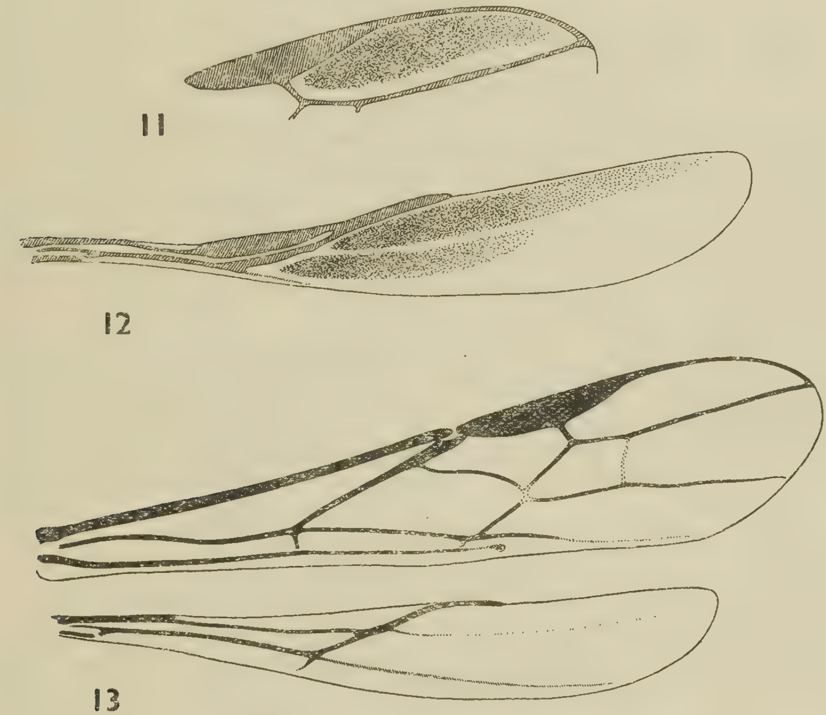
The essential features of the subfamily reduce to three, namely, (1) the position of the nervus parallelus, (2) the position of the recurrens, and (3) the form of the petiole.

Enderlein (1912) seems to have been the only writer to form any ideas about the affinities of the SPATHIINAE. On the shape of the 1st abdominal tergite, he grouped together a number of genera, which, because of a superficial resemblance to the SPATHIINAE, were likely to be confused with this subfamily, and made of them a new subfamily, the STEPHANISCINAE. To do him justice, he took this step for practical reasons but it led him to make conflicting statements and to draw false conclusions. He characterised the STEPHANISCINAE as follows :—" 1st abdominal segment lengthened in the form of a stalk (3 or more times as long as wide) but its sides forming a straight continuation of the sides of the rest of the abdomen; the segment is thus (gradually) widened towards apex." The genera which he placed in the STEPHANISCINAE are the following :—

(1) *Stephaniscus* Kieffer. (Genotype: *Stenophasmus oncophorus* Schletterer, 1889. Monobasic. Cape.)
(2) *Leptospathius* Szepligeti (see p. 188).
(3) *Pseudospathius* Szepligeti (see p. 189).
(4) *Doryctophasmus* Enderlein. (Genotype: *Doryctophasmus ferrugineiceps* End., 1912. Monobasic. Dutch New Guinea.)
(5) *Acrophasmus* Enderlein. (Genotype: *Acrophasmus exilis* End., 1912. Monobasic. Colombia.)
(6) *Trigonophasmus* Enderlein. (Genotype: *Trigonophasmus schenklingi* End., 1912. Monobasic. Peru.)
(7) *Ogmophasmus* Enderlein (see p. 189).

Leaving out of account *Pseudospathius* Szepligeti, which is a true Spathiine, all the other genera, with the exception of *Doryctophasmus* Enderlein, have the nervus parallelus inserted below, and because of this fact and for other reasons are not at all closely related to the SPATHIINAE; it is extremely doubtful if they are even closely related among themselves. As for *Doryctophasmus*, which Enderlein thinks it would be advantageous to unite with *Pseudospathius* to form the "Pseudospathiini", its resemblance to this genus is, I think, purely fortuitous; for Enderlein it rests on a single character, *i.e.*, the interstitial nervus parallelus. He takes none of the other features of this highly interesting genus into account in order to determine its relationships. I am confident that I have interpreted *Doryctophasmus* correctly; the hind-wing of the male is very characteristic (fig. 12); the facies of the fore-wing of the female is different from that of the fore-wing of the SPATHIINAE, although the relative position of the veins is much the same (figs. 13 and 11, ♂). To me, this resemblance is just another example of those cases of convergence which obscure the relationships of the cyclostome BRACONIDAE.

In the SPATHIINAE proper Enderlein includes the following genera:—(1) *Spathius* Nees; (2) *Rhoptrospathius* Cameron (see p. 189); *Stenophasmus* Smith (see p. 189); *Psenobolus* Reinhard, 1885. (Genotype: *Psenobolus pygmaeus* Reinh., 1885. Monobasic. Brazil). I shall show later that *Rhoptrospathius* is a synonym of *Leptospathius* Szepligeti (p. 188), which Enderlein included among the STEPHANISCINAE! The synonymy should have been apparent to him if he had troubled to study the original descriptions carefully. Altogether, he has been unable to set well-defined limits either to the STEPHANISCINAE or to the SPATHIINAE.



FIGS. 11–13.—*Doryctophasmus*? *ferrugineiceps* Enderlein:—11. Radial cell of fore-wing, ♂; 12. Hind-wing, ♂; 13. Wings, ♀.

Roman (1924) has had occasion to handle the South American representatives of Enderlein's STEPHANISCINAE in an interesting paper in which he has some pertinent things to say about the inadequacy of the classification of the BRACONIDAE to assimilate extra-european genera. He finds Enderlein's new subfamily untenable. He is probably right if we accept it in its present shape. If, on the other hand, we agree with him, as I do, that the European classification is too rigid to cover world-forms, and if the task of reconstructing it is eventually undertaken, then, room will, I think, be found for the STEPHANISCINAE, reduced in size perhaps and certainly less indigestible.

Whether it will rank as tribe or subfamily will depend on factors as yet uninvestigated.

The question of a new or modified Braconid classification inevitably affects the status of the SPATHIINAE whose obvious relationship with some of the widely different elements that at present make up the DORYCTINAE will have to be expressed in logical form. As the classification now stands, there is nothing to suggest that these two subfamilies are more closely related to each other than either is to the RHOGADINAE or the HORMIINAE, for example. This indicates a great weakness in the present arrangement of the subfamilies that comprise the large group of BRACONIDAE with the characteristic infra-clypeal opening. A possible remedy would be to degrade the SPATHIINAE to the rank of a tribe and include it, along with several other tribes of equal value, in a newly defined DORYCTINAE. The SPATHIINAE have, of course, already been treated as a tribe by Ashmead (1900), Handlirsch (1924) and Fahringer (1928). But these writers have treated the other related subfamilies also as tribes. Their concern seems to have been about the correct application of a category, rather than whether a category, be it tribe or subfamily, should express degrees of relationship.

The definition of the DORYCTINAE, as generally given, is almost frivolous in its vagueness: Head cubical or almost so; occiput rarely unmargined; 3 cubital cells present in fore-wing (Marshall, 1888 and Szepligeti, 1904). Roman (*loc. cit.* : 3) shows that the occiput-character cannot be used, and certainly the value of the head is almost negligible as an aid towards defining the subfamily.

To return to the SPATHIINAE, the only contribution to our knowledge of the subfamily since Enderlein's venture has been Wilkinson's paper on the Indo-Australian and Ethiopian species. He deals with twenty-six species, fifteen of them his own. His new species are described with the carefulness which is characteristic of all his work. But it was inevitable, with so few species, that he should have overlooked many of the taxonomic features which I have found to be valuable.

GENERA ASSOCIATED WITH THE SPATHIINAE.

The American genera are not included in this list but I have considered them; they are:—*Cantharoctonus* Viereck, *Ipospathius* Enderlein, *Lissophrymnus* Cameron and *Psenobolus* Reinhard.

(1) *Habnoba* Cameron (see *Leptospathius*).

(2) *Leptospathius* Szepligeti

1902, *Természetr. Füz.* **25** : 49. (Genotype: *Leptospathius formosus* Szep., Queensland. Monobasic.)

1905, *Habnoba* Cameron, *J. Straits Br. Asiat. Soc.* **44** : 107. (Genotype: *Habnoba petiolata* Cam., Sarawak. Monobasic.) **Syn. n.**

1910, *Rhoptrospathius* Cameron, *Tijdschr. Ent.* **53** : 47. (Genotype: *Rhoptrospathius striatus* Cam., Ceylon. Monobasic.) **Syn. n.**

Included by Szepligeti in the SPATHIINAE, this genus, which I am confident I know, is most certainly wrongly placed here. The nervus parallelus is inserted below and the radial cell of the hind-wing is divided by a transverse vein; tergite (2 + 3) is provided on basal half with a pair of obliquely placed furrows. I have shown the wings of *Leptospathius* in fig. 10. Both *Habnoba* and *Rhoptrospathius* were included by their author Cameron among the SPATHIINAE.

(3) *Metaspathius* Brues

1922, *Psyche* **29** : 218. (Genotype : *Metaspathius apterus* Brues, New Zealand. Monobasic.) Brues considered that his genus belonged to the Spathiinae, but I have been reluctant to include it in the present work as I do not know it in nature. For full description see appendix.

(4) *Platyspathius* Viereck. Dealt with in the present work.

(5) *Pseudospathius* Szepligeti. Dealt with in the present work.

(6) *Rhacospathius* Cameron. Synonym of *Spathius*.

(7) *Rhopalospathius* Cameron.

1912, *Ann. Soc. ent. Belg.* **56** : 368. (Genotype : *Rhopalospathius auranteiceps* Cam., Belgian Congo. By present designation.)

1911, *Biphymaphorus* Szepligeti, *Wiss. Ergebn. 2te. dtsch. Afr. Exped.* **3** (1) : 407. (Genotype : *Biphymaphorus rufithorax* Szep., Uganda. By designation of Brues.) **Syn. n.**

1912, *Ogmophasmus* Enderlein, *Arch. Naturgesch.* **78** (A) (2) : 13. (Genotype : *Stenophasmus ingens* End., W. Africa. Original designation.).

1924, *Ogmophasmus* End., Brues, *Ann. S. Afr. Mus.* **19** : 11.

Superficially *Rhopalospathius*, which Cameron originally placed among the Spathiinae and which falls as a synonym of *Biphymaphorus*, looks like a typical member of the Spathiinae, but the resemblance is, I think, accidental. *Biphymaphorus* is chiefly characterised by the large swelling (similar to what occurs in *Dendrosoter* Wesmael) on each side of the frons; the recurrens is received into the 1st cubital cell and the nervus parallelus arises from the lower apical angle of the 2nd discoidal cell; tergite (2 + 3) has a longitudinal furrow on each side on basal half; for the benefit of future workers I give an illustration of the wings of *Biphymaphorus auranteiceps* (Cam.) in fig. 9.

(8) *Rhoptrospathius* Cameron (see *Leptospathius*).

(9) *Stenophasmus* Smith

Treated as a synonym of *Spathius* in the present work. Although the genus had been previously sunk by Szepligeti, Enderlein (1912 : 9) re-instated it on the strength of the genotype, *Spathius ruficeps* (Smith), possessing unarmed hind coxae. It is obvious, however, from the wide interpretation he gave to the genus that he had been unable to form a clear idea of its limits.

(10) *Schlettereriella* Szepligeti

1904, *Gen. Ins.*, *Braconidae*, fasc. 22a : 54. (Genotype : *Stenophasmus oncophorus* Schlett., Cape Province. By designation of Szepligeti.)

Falls as a synonym of *Stephaniscus* Kief, Kieffer *in* André, *Hymen. Europe Alg.* **7** (bis) : pl. 478.

Included by Szepligeti in the Spathiinae, this genus is not at all closely related to this subfamily. The nervus parallelus is inserted below.

SYSTEMATIC TREATMENT OF THE SPATHIINAE.

Key to the genera of the SPATHIINAE.

1. Occiput not margined. (Large sp., 7–10 mm., without ovipositor; strikingly coloured, the head pale yellow, the thorax pale reddish-yellow and the abdomen black, marked with ivory white at base and beneath; segment 3 of the hind tarsus of the ♀ 1½ times as long as 5)
Sisupala gen. n. Fiji Is. (p. 421).

–. Occiput always margined, at least laterally . . . . 2.

2. Very large, strikingly coloured spp., 12–15 mm., without ovipositor; the head yellowish, the thorax entirely or in greater part reddish and the abdomen entirely black (Segment 3 of the hind tarsus hardly half 5)
Pseudospathius Szepligeti. New Guinea; Solomons (p. 418).

–. Spp. rarely as large as 12 mm., and then almost entirely black; colour combination never as above . . . . 3.

3. Front and middle femora with a blister-like swelling near base above; epipleura of the true 2nd and 3rd tergites not fused; petiole gradually widened from spiracles to apex, never abruptly dilated at apex. (Almost always dark brown spp., the hind tibiae never paler at base; the mesonotum posteriorly usually without raised sculpture or, if any is present, then a clearly defined suture exists between tergites 2 and 3; tergites (2 + 3) and 4 always with sharply differentiated lateral margin; fore-wing strongly dappled with black and white; medius very deeply curved (fig. 281)) . . . . 4.

–. Front and middle femora without such a blister-like swelling; epipleura of the true 2nd and 3rd tergites fused; petiole more or less abruptly dilated at apex . . . . 6.

4. Nervulus very widely antefurcal; darkened part of the fore-wing proximal to the basal hyaline fascia completely without pubescence; membrane of the petiole covering about apical $\frac{1}{5}$ *Parana* gen. n. India (p. 435).

–. Nervulus at most very slightly antefurcal; darkened part of the fore-wing proximal to the basal hyaline fascia always pubescent; membrane of the petiole covering at least apical half . . . . 5.

5. 2nd abscissa of the radius less than $\frac{1}{3}$ as long as the 3rd; recurrens interstitial; 2nd discoidal cell very short, $2\frac{1}{2}$ times as long as apically wide (fig. 283); metacarpus without a complete fringe of hairs, at most a very few, widely spaced hairs being present. *Toka* gen. n. S. Africa (p. 434).

–. 2nd abscissa of the radius at least $\frac{2}{3}$ as long as the 3rd; recurrens always received clearly into the base of the 2nd cubital cell; 2nd discoidal cell much longer (fig. 281); metacarpus with a complete fringe of hairs
Platyspathius Viereck. Africa; Indo-australian region (p. 423).

6. Scape elongate, cylindrical, fully twice as long as wide measured on longest side; its apical rim distinctly reflexed and hence not closely wrapped around the pedicel; (*rabirius* sp. n., is exceptional in this last respect); hind coxa narrowly ovate and as long, or nearly as long, as the short, swollen hind femur. (Very slender spp., always macropterous, with the pronotal keel very strongly developed, free, the mesonotum only very slightly declivous in front and the hind femur abruptly narrowed at base)
Paraspathius gen. n. Malaya; Borneo; Philippines (p. 410).

–. Scape short, cup-shaped, usually not more than $1\frac{1}{2}$ times as long as wide, its apical rim always simple; if somewhat longer than this, then the mesonotum is strongly gibbose in front and falls perpendicularly to the pronotum; hind coxa usually much shorter than the hind femur or, if not, then the latter is not abruptly narrowed at base. (Spp. very rarely micropterous)
Spathius Nees. Old World (p. 190).

Spathius Nees.

1818, *Spathius* Nees, *N. Acta. Acad. Nat. Curios. Halle* **9** : 301.

1836, ?*Celereon* Say, *Boston J. nat. Hist.* **1** : 257. (Genotype: *Bracon inescator* Say, by designation of Viereck.)

1859, *Stenophasmus* Smith, *Trans. Linn. Soc. Lond. Zool.* **3** : 169. (Genotype: *Stenophasmus ruficeps* Smith. Monobasic.)

1862, *Euspathius* Förster, *Verh. Nat. Ver. preuss. Rheinl.* **19** : 236 (no species described).

1905, *Rhacospathius* Cameron, *Spol. Zeylan.* **3** : 86. (Genotype: *Rhacospathius striolatus* Cam. Monobasic.)

Colour extremely variable, but it can be said that the larger the species (groups of *caenius* and of *ruficeps*), in which size can reach 11 mm., the darker they are; there is never any approach to the brilliant combination of colours shown by the large species of the tropical genus *Pseudospathius* Szepligeti.

Head always of very simple form. Scape of the antenna simple; flagellum 1 usually longer than 2, rarely as long but never shorter. Ocelli rarely in an equilateral triangle; base almost always clearly longer than sides, never shorter. Occiput margined; very rarely the margin obliterated above (*aristaeus* sp. n.). Thorax rarely compressed dorso-ventrally (group of *labdacus*). Pronotal frequently with a transverse keel but only in one species (*ochus* sp. n.) transversely swollen. Hind coxa with or without a dentiform projection beneath at base. Species rarely micropterous; 2nd abscissa of the radius rarely a trifle shorter than the 1st transverse cubitus (groups of *exarator* and *vulnificus* in part), usually very distinctly longer; recurrens almost always received very distinctly into the base of the 2nd cubital cell; sometimes more or less interstitial but never received into the 1st cubital cell; nervulus interstitial or nearly so; nervus parallelus *always* arising from at least slightly above middle of distal side of 2nd discoidal cell; submediellan cell of hind-wing always short, the 1st abscissa of the mediella always shorter than the 2nd; costellan cell never very narrow (cf. Doryctine genus *Leptospathius* Szepligeti, fig. 10). Abdomen petiolate, the petiole abruptly dilated at apex. Gaster sculptured or smooth, very variable in appearance, usually showing 6 movable segments (the fused 2nd and 3rd tergites counted as one segment); very rarely with as few as 3 visible segments (that is, tergites (2 + 3)–5, the remaining tergites being retracted beneath 5 as in part of the group of *striolatus* Cam.); tergite (2 + 3) never with a suture or furrow marking the division between its two component parts, the epipleura of its two component parts always fused; sometimes tergite (2 + 3) has a completely differentiated lateral margin and in such cases the epipleura is more finely sculptured—or not at all—than the dorsum of the tergite; a similar margin may occur on tergites 4 and 5. Ovipositor of the female very variable in length but always at least half as long as the gaster.

Type of the genus :—*Ichneumon exarator* L.

Key to the species-groups of *Spathius*.—Females.

1. Entire or almost entire face having a satiny sheen due to a sculpture of excessively fine, absolutely even, transverse aciculation, like the surface of a gramophone record (fig. 201) . . . . 2.

–. Face without such a sheen, its sculpture, when present, never consisting of such fine aciculation . . . . 5.

2. Mesopleura coarsely rugose everywhere. (Dark brown sp., *c.* 4 mm., with pale brown head; tergite (2 + 3) dull, extremely finely rugose-aciculate) group of *ocyroe* sp. n. Philippines (p. 358).

–. Mesopleura at least medially with at most a fine surface sculpture . . . . 3.

3. Medius of the fore-wing taking a deep downward sweep at middle, the submedian cell hence distinctly constricted here (fig. 192) . . . . 4.

–. Medius of the fore-wing taking at most a slight downward curve at middle, the submedian cell hence merely narrowed towards apex. (Hind coxa with distinct basal projection; 2nd abscissa of the radius not or only slightly longer than 1st intercubitus) group of *vulnificus* Wilk. India (p. 361).

4. Fore-wing conspicuously dappled, the submedian cell at its narrowest crossed by a broad dark fascia. (Spp. with the notaulices often virtually absent on horizontal surface of mesonotum; mesonotum almost always sharply truncate in front with prominent " shoulders " group of *rusticulus* Wilk. (p. 351).

–. Fore-wing at most faintly dappled, the submedian cell at its narrowest not crossed by a dark fascia. (Entirely pale yellowish spp. with the mesonotum sloping very gradually to the pronotum)
group of *urios* sp. n. Malaya; Philippines (p. 359).

5. Micropterous species. (Gaster usually smooth all over, at most with a microscopic sculpture giving it an opaque appearance) . . . . . 6.

–. Macropterous species . . . . 9.

6. Mesonotum appearing hollowed out in the middle, the cavity shining and smooth except for a fine median keel; longer axis of the eye twice the length of the malar space . . group of *turneri* sp. n. Australia (p. 370).

–. Mesonotum not as above; longer axis of the eye at most 1½ times the length of the malar space . . . . 7.

7. Scutellum normal, almost flat; propodeum completely areated; hairs of the upper surface of the hind tibia outstanding, almost erect, clearly longer than the narrowest width of the tibia
group of *cursor* Wilk. S. Africa (p. 369).

–. Scutellum in the form of a rounded hump or conical projection; propodeum not areated; hairs of the upper surface of the hind tibia almost recumbent, not longer than its narrowest width . . . . 8.

8. Propodeum, seen from the side, strongly swollen, convex above and almost on a level with the scutellum; hairs of the upper surface of the hind tibia much shorter than its middle width; gaster smooth, shining.
group of *exarator* L. Europe (p. 197).

–. Propodeum, seen from the side, not strongly swollen nor convex, lying far below the level of the scutellum; hairs of the upper surface of the hind tibia hardly shorter than its middle width; gaster faintly matt.
group of *apotanus* Wilk. S. Africa (p. 367).

9. Mesonotum completely smooth and shining (no trace of notaulices)
group of *pasyphae* sp. n. Philippines (p. 398).

–. Mesonotum always with some kind of sculpture . . . . 10.

10. Petiole very long and narrow, fully 3 times as long as the propodeum; tergite (2 + 3) much longer than apically wide, either unsculptured or with a variable amount of smooth aciculation. (Extremely slender spp. with the vertex always smooth (fig. 235); hind tarsus 3 as long as 5)
group of *imbecillus* End. Malaya; Borneo; Philippines (p. 400).

—. Petiole rarely 3 times as long as the propodeum and then the vertex with strong sculpture and/or tergite (2 + 3) without smooth aciculation or hind tarsus 3 considerably shorter than 5 . . . . 11.

11. Tergite (2 + 3) with some kind of sculpture at least within a large basal area, usually sculptured all over or almost all over; if the sculpture is much reduced, it never consists of longitudinal rugulosities or striation at extreme base of segment (but cf. group of *imbecillus*, p. 400). . . . 12.

—. Tergite (2 + 3) unsculptured, shining, at most with a few inconspicuous longitudinal rugulosities or striation at extreme base . . . . . . 47.

12. Head and thorax conspicuously flattened dorso-ventrally, the pronotum lying virtually in the same plane as the mesonotum
group of *labdacus* Nixon (part). India; Borneo; Malaya; Philippines (p. 371).

—. Head and thorax not flattened, the pronotum by no means lying in the same plane as the mesonotum . . . . 13.

13. Tergite 4 disproportionately larger than 5 and strongly striate-rugose right up to the apical margin. (Spp. with the vertex completely or almost completely smooth; tergite 4 with a sharp, completely differentiated lateral margin)
group of *leucippus* sp. n. Malaya; Java; Philippines; Formosa (p. 315).

—. Tergite 4 not disproportionately larger than 5 or if somewhat disproportionately larger, then there is no striate element in its sculpture . . . . 14.

14. Segment 1 of the hind tarsus about 3 times as long as 2 . . . . 15.
—. Segment 1 of the hind tarsus at most about $2\frac{1}{3}$ times as long as 2 . . . . 16.
15. Upper surface of the hind tibia without outstanding hairs; mesonotum posteriorly without a trace of raised sculpture
group of *berlandi* sp. n. Madagascar (p. 366).
—. Upper surface of the hind tibia with outstanding hairs; mesonotum posteriorly with much raised sculpture. (Slender sp. with smooth vertex; tergite (2 + 3) clearly longer than apically wide, sharply margined laterally as is also tergite 4; 2nd abscissa of the mediella hardly twice as long as the 1st)
group of *testaceitarsis* Cam. Borneo; Malaya; Philippines (p. 333).
16. Tergite 5 with a sharp, completely differentiated lateral margin situated below the spiracle; the epipleura of this tergite thin, membranous and with a sculpture entirely different from that of the tergite. (Medius of the fore-wing at most slightly curved (fig. 165); tergite (2 + 3) with a strong striate element in its sculpture) . . . . 17.
—. Tergite 5 without a differentiated margin, at most very sharply reflexed laterally and then the medius is very strongly sinuate or tergite (2 + 3) is without longitudinal elements in its sculpture or the gaster is brown with the basal $\frac{2}{3}$ of tergite (2 + 3) orange-yellow . . . . 18.
17. Pronotal keel strongly developed, free; mesonotum sloping very gradually to the pronotum; gaster almost parallel-sided; tergites 4 and 5 deep yellow with a large red-brown basal patch
group of *seriphus* sp. n. Malaya (p. 322).
—. Pronotal keel hardly developed and if distinct then not free; mesonotum almost truncate in front, falling vertically to the pronotum; tergites 4 and 5 differently coloured
group of *striolatus* Cam. Ceylon; Borneo; Philippines (p. 323).
18. Tergite 4 margined right to apex; epipleura of this tergite and of tergite (2 + 3) thin, membranous, completely unsculptured. (Always a conspicuous longitudinal element in the sculpture of tergite (2 + 3); hairs of the mesonotum outstanding, sparse) . . . . 19.
—. At most tergite (2 + 3) margined and then not or hardly beyond the second spiracle; if tergite 4 as well as (2 + 3) is sharply reflexed and hence *appears* to have a differentiated margin, then tergite (2 + 3) either has no longitudinal elements in its sculpture or the mesonotum is densely clothed with short, more or less adpressed hairs . . . . 21.
19. Gaster dark brown with the basal $\frac{2}{3}$ of tergite (2 + 3) orange yellow. (Sp. with the head and thorax blackish; vertex smooth)
group of *striolatus* Cam. (part) (p. 323).
—. Gaster not thus coloured . . . . 20.
20. Tergite (2 + 3) with very fine, smooth, even striation; petiole very long and slender, almost unsculptured; head dark brown. (Sp. of delicate build with tergite 4 sculptured like (2 + 3))
group of *philodemus* sp. n. Borneo (p. 299).
—. Tergite (2 + 3) never with smooth striation, the intervals between the ridges rugulose; petiole of average length, much sculptured; head entirely reddish-yellow or whitish with a conspicuous brown patch behind each eye
group of *pompelon* sp. n. Borneo; Philippines (p. 319).
21. Radius leaving stigma far beyond the middle. (Predominantly yellow-testaceous species, dappled with brown; vertex transversely striated)
group of *moderabilis* Wilk. Madeira (p. 203).
—. Radius leaving stigma at most slightly beyond middle . . . . 22.
22. Tergites (2 + 3)–4 and to a less extent 5, finely longitudinally striated
group of *piperis* Wilk. D.E. Indies (p. 397).

—. At most tergite (2 + 3) with longitudinal striation . . . . 23.

23. Vertex either completely smooth or with a variable amount of transverse striation or aciculation which is, on the whole, smooth and regular . 24.

—. Vertex never smooth, the surface having either a vague, more or less scaly-reticulate sculpture or if striation or aciculation is present, it is not smooth but at least in part is broken up into, or tends to be obscured by, rugulosity . . . . 41.

24. Tergite (2 + 3) with a distinctly differentiated margin extending about as far as the second spiracle, rarely to apex; vertex smooth or almost so . . 25.

—. Tergite (2 + 3) with at most a trace of a margin and then it does not extend as far as the second spiracle and the vertex is striate . . . . 30.

25. Mesonotum strongly gibbose in front, falling vertically to the pronotum; no trace of a pronotal keel. (Entirely yellowish-brown species with all the tibiae blackened; tergite (2 + 3) very finely reticulate-punctate)
group of *philoctetes* sp. n. Philippines (p. 329).

—. Mesonotum not gibbose in front and not falling vertically to the pronotum; pronotal keel present, very distinct . . . . 26.

26. Mesonotum densely clothed with short, more or less adpressed hairs. (Spp. with the pronotal keel widely free, very prominent)
group of *imbecillus* End. (part) (p. 400).

—. Mesonotum clothed only with sparse outstanding hairs . . . . . . 27.

27. Tergite (2 + 3) about twice as long as apically wide; 2nd abscissa of the mediella fully 3 times as long as the 1st. (Large bicoloured species with the head and thorax more or less reddish and the abdomen dark brown; hind coxae and hind trochanters dark brown)
group of *metrodorus* sp. n. Borneo (p. 335).

—. Tergite (2 + 3) at most slightly longer than wide apically . . . . 28.

28. Mesonotum uniformly pale brownish-yellow. (Sp. with the mesopleura dull, scaly-reticulate all over the disc; hind coxae darkened on inner and outer side but otherwise yellowish)
group of *trochanteratus* Szepligeti. W. Africa (p. 337).

—. At least the lateral lobes of the mesonotum darkened . . . . 29.

29. Apical half of tergite (2 + 3) with fine, mostly broken, transverse aciculation; hind coxa yellow. (Pronotum yellow or reddish-yellow; mesopleura blackish and the propodeum pale at least laterally)
group of *scotti* Wilk. Seychelles (p. 336).

—. Apical half of tergite (2 + 3) with very fine punctate-reticulation. (Uniformly brown species with the front and middle coxae honey-yellow)
group of *zamus* sp. n. Philippines (p. 334).

30. Mesonotum clothed, usually densely, with short pubescence all over; vertex smooth or almost so. (Spp. with tergites beyond (2 + 3) either smooth or with at most faint scaly-reticulation at base, never aciculate)
group of *tityrus* sp. n. Malaya; Borneo; Philippines; Ladrones (p. 303).

—. Mesonotum very rarely with short pubescence and then the vertex is strongly sculptured; the mesonotal hairs outstanding . . . . . . 31.

31. Vertex completely smooth; medius hardly sinuate; gaster never with aciculation on tergites 4 and 5. (Spp. with the middle lobe of the mesonotum gibbose and prominent in front; notaulices well defined; mesonotum posteriorly always with an area of coarse rugosity) . . . . 32.

—. Vertex usually with at least faint traces of sculpture; if virtually smooth then the medius is deeply sinuate or tergites 4 and 5 with extremely fine, more or less transverse aciculation . . . . 33.

32 Hind coxa without a trace of a projection beneath; tergite (2 + 3) sculptured virtually all over; hind tibia with long bristly hairs on its upper surface which are more or less erect and fully equal to the width of the tibia
group of *voltur* sp. n. Philippines; Borneo (p. 313).

—. Hind coxa with a small dentiform projection beneath; tergite (2 + 3) with at least the broad apical margin unsculptured; hind tibia with only short, semi-erect hairs which are clearly shorter than the width of the tibia . . . . . group of *exarator* L. Palearctic reg.; India (p. 197).

33. Mesonotum posteriorly virtually without raised sculpture, at most a single fine ridge being present, the 2 posterior carinae never defined; notaulices more or less obliterated on the disc. (Spp. with the palpi blackened or darkened, almost throughout; fore-wing usually conspicuously dappled; medius deeply sinuate) group of *dissors* Wilk. (part). Philippines (p. 341).

—. Mesonotum posteriorly with some sort of raised sculpture, at least the 2 posterior carinae being indicated; notaulices distinct throughout, even if vague in outline . . . . 34.

34. Median lobe of the mesonotum sharply angularly truncate in front, the base of the truncature lying a little posterior to its apex, the truncature itself flat or a little concave group of *dissors* Wilk. (part). India (p. 341).

—. Median lobe of ordinary form . . . . 35.

35. Segment 3 of the hind tarsus about 1½ times as long as 5; apical lobe of the hind tibia without a row of spines. (Very large, blackish spp., 8–11 mm.; gaster with a predominating sculpture of fine aciculation) group of *caenius* sp. n. Malaya; Borneo; Philippines (p. 384).

—. Segment 3 of the hind tarsus not or hardly longer than 5; apical lobe of the hind tibia always with a row of at least 5 spines. . . . . 36.

36. Mesonotum sloping gradually to the pronotum; pronotal keel widely fused with the posterior margin of the pronotum. (Spp. with the post-tegulae brownish; gaster with extremely fine granulation, more or less shagreened but without aciculation) group of *dissors* Wilk. (part) (p. 341).

—. If the mesonotum slopes gradually to the pronotum, then the pronotal keel is well developed and free . . . . 37.

37. Mesonotum sloping gradually to the pronotum; pronotal keel free, well developed, conspicuous . . . . 38.

—. Mesonotum falling more or less vertically to the pronotum; pronotal keel wanting, or if fairly well developed, then it is fused medially with the posterior margin of the pronotum . . . . 40.

38. Sculpture of tergite (2 + 3) consisting of fine punctate-reticulation which weakens on tergite 4 to irregular scaly reticulation group of *ruficeps* Smith (part) (p. 373).

—. Sculpture of tergite (2 + 3) and of 4 at least on the broad apical margin consisting of fine aciculation, which on tergite (2 + 3) is sometimes obscured by fine rugosity but is always more or less distinct towards the sides of the segment . . . . 39.

39. Segment 3 of the hind tarsus hardly ⅔ as long as 5. group of *nyctimene* sp. n. Madagascar (p. 393).

—. Segment 3 of the hind tarsus as long, or almost as long, as 5 group of *ruficeps* Smith. Indo-austr. reg. (p. 373).

40. At least the middle lobe of the mesonotum with fine pubescence; tergite (2 + 3) with fine aciculation everywhere group of *vesevus* sp. n. Philippines (p. 395).

—. Mesonotum with only outstanding hairs; tergite (2 + 3) extremely finely punctate-reticulate group of *elaboratus* Wilk. India; Borneo; Philippines (p. 386).

41. Mesonotum posteriorly without raised sculpture, being merely scaly-reticulate here . . . group of *dissors* Wilk. (part). S. Africa (p. 341).

—. Mesonotum posteriorly always with some kind of raised sculpture . . . 42.

42. Sides of the propodeum and of the metapleura evenly and strongly transversely ribbed; mesonotum without outstanding hairs. (Deep brown species with the thorax almost bare; medius deeply sinuated; fore-wing

strongly darkened but without a pale band at the narrowest part of the submedian cell; gaster dull, finely rugulose everywhere)
group of *pleuralis* Szepligeti. Africa (p. 339).

—. Sides of the propodeum and of the metapleura without such sculpture; mesonotum with outstanding hairs . . . . 43.

43. Flagellum 1 considerably longer than scape plus pedicel, virtually bare on its inner, curved side . . . . group of *ruficeps* Smith (part) (p. 373).

—. Flagellum 1 not or hardly longer than scape plus pedicel and with hairs on its inner side . . . . 44.

44. Medius deeply sinuate; fore-wing conspicuously dappled with black and white (hardly conspicuously in *spilopterus* Cam.) submedian cell at its narrowest crossed by a hyaline fascia, somewhat ill defined in *spilopterus*. (Spp. with no longitudinal elements in the sculpture of tergite (2 + 3)) 45.

—. Medius almost straight; fore-wing not dappled thus, the submedian cell not crossed by a hyaline fascia . . . . 46.

45. Pronotal keel strongly developed, widely free
group of *labdacus* Nixon (part) (p. 371).

—. Pronotal keel either more or less absent or if fairly strongly developed, then fused with the posterior margin of the pronotum
group of *spilopterus* Cam. Borneo; Malaya (p. 331).

46. Tergite (2 + 3) with vague punctate-reticulation; vertex finely rugulose all over, virtually without a trace of transverse elements; hind coxae yellow
group of *philotas* sp. n. Philippines (p. 339).

—. Tergite (2 + 3) with excessively fine, patchy aciculation; vertex with strong striation which becomes much wrinkled towards and to sides of ocelli; hind coxae brownish . . group of *nyctimene* sp. n. Madagascar (p. 393).

47. Nervus recurrens arising from the nervus parallelus at an appreciable distance from the apex of the 2nd discoidal cell. (Vertex sculptured; pronotal keel free, well developed; petiole very long and narrow)
group of *apidanus* sp. n. Aru (p. 273).

—. Nervus recurrens arising from the apex of the 2nd discoidal cell . . . . 48.

48. Gaster very narrow; tergite (2 + 3) longer than its apical width. (Sp. with the petiole long and narrow; thorax, petiole and legs black; head and gaster orange-yellow) . . group of *briareus* sp. n. Africa (p. 272).

—. Gaster much less narrow; tergite (2 + 3) usually transverse and when not, then the colour of the body is never so strikingly characteristic as above 49.

49. Hind tibia clothed only with very short, inconspicuous hairs all over; these hairs much shorter than the width of the tibia and in one species virtually absent along its upper surface. (Spp. with the mesonotum clothed only with very short hairs or almost bare; between the 1st and 2nd abscissae of the radius almost a right angle)
group of *capaneus* sp. n. India; Philippines (p. 300).

—. Hind tibia clothed, at least above, with long erect hairs which, at their shortest, are only a little shorter than the middle width of the tibia and then the mesonotum is clothed with long outstanding hairs . . . . 50.

50. Tergite (2 + 3) with a sharp, completely differentiated, lateral margin extending to nearly half-way between the 2nd spiracle and the apex . . 51.

—. Tergite (2 + 3) without such a margin . . . . 52.

51. Head and thorax intensely black; mesonotum nearly smooth, having only ill-defined puncture-like impressions and vague foveae. (Sp. with the notaulices wanting) . . group of *aristaeus* sp. n. Philippines (p. 297).

—. Head and thorax reddish; mesonotum almost everywhere with strong shining rugosities . group of *pelides* sp. n. Borneo; Philippines (p. 295).

52. Middle tarsus thick and very short, segment 1 being hardly twice as long as wide; 2nd abscissa of the radius markedly longer than the 3rd. (Spp. with the vertex smooth) group of *capys* sp. n. Philippines (p. 270).

—. Middle tarsus not as above, segment 1 being much longer; 2nd abscissa of the radius at most as long as the 3rd . . . . 53.

53. Medius deeply sinuate, the submedian cell hence constricted beyond middle. (Spp. with the hind coxa unarmed beneath; colour dark brown with the front and middle coxae whitish-yellow and the hind coxae and hind femora dark brown)
group of *arcesius* sp. n. New Guinea; Queensland (p. 391).

—. Medius not deeply sinuate, the submedian cell not constricted beyond middle . . . . 54.

54. Petiole very long and narrow; vertex sculptured all over; hind coxa narrowly oval, without a basal projection. (Spp. with the mesopleura and dorsal areas of the propodeum dull, covered with a characteristic sculpture of close, even scaly-reticulation)
group of *cassidorus* sp. n. Solomons; New Guinea (p. 267).

—. Species without the above combination of characters . . . . 55.

55. Infraclypeal cavity fully twice as wide as long, the tentorial pits considerably or much further from each other than either is from an eye (fig. 114); 1st and 2nd abscissae of the radius forming a straight line (fig. 110), except in *opis* sp. n.
group of *alipes* Wilk. Africa; Indo-australian region (p. 274).

—. Infraclypeal cavity nearly circular, less than twice as wide as long, the tentorial pits at most a little further from each other than either is from an eye; 1st and 2nd abscissae not forming a straight line
group of *fasciatus* Walker. Africa; Indo-australian region (p. 204).

Group of *exarator* L.

Characters: Vertex always smooth; head subcubical, at most only very slightly narrower behind the eyes than across them. Pronotal keel not or only very feebly developed; when distinct always fused medially with the posterior margin of the pronotum. Hind coxa always with a dentiform projection; hairs of the upper surface of the hind tibia always very short, distinctly shorter than its middle width. With or without wings; nervus parallelus never interstitial. Tergite (2 + 3) rarely completely smooth, usually with a rather sharply delimited basal area of loose scaly-reticulation amongst which a few fine longitudinal carinae may occur. Ovipositor sheaths of the female variable in length.

PALEARCTIC REGION; INDIA. Seven species.

Owing to the impossibility of communicating with continental workers at the present time to obtain information about the following species, I have had difficulty in understanding what previous writers have meant by the names they have used. Neither Marshall (1888) nor Fahringer (1930) has succeeded in giving a clear picture of the species they have interpreted as *rubidus* Rossi, and *erythrocephalus* Wesmael, for example. I have, therefore, been obliged to determine from the original descriptions the material I have had before me but I do not claim to be completely satisfied with the result. Except in the case of *exarator* L., a species about the identity of which I think there can be no doubt, I have introduced no synonymy, for obvious reasons. I have included all host-records, however, for what they are worth.

Key to the species of the *exarator* group.—Females.

1. Apterous species . . . . *pedestris* Wesmael.

–. Fully winged species . . . . 2.

2. Tergite (2 + 3) shining, smooth, at most with extremely faint traces of sculpture. Hind tibia pale on nearly basal half)
erythrocephalus Wesmael.

–. Tergite $(2 + 3)$ at least on basal half very distinctly, though rather indefinitely sculptured, but then the hind tibia is pale only at extreme base (about basal $\frac{1}{6}$) . . . . 3.

3. Hind tibia pale on about basal $\frac{2}{5}$. (Spp. with the ovipositor sheaths at least as long as the petiole plus gaster) . . . . 4.

–. Hind tibia pale only on about basal $\frac{1}{6}$ or hardly pale at all basally . . . . 5.

4. Ovipositor sheaths fully as long as the abdomen plus thorax; basal carina of the propodeum long, fully as long as its forks or longer; these often undefined . . . . *exarator* L.

–. Ovipositor sheaths as long as abdomen plus propodeum; basal carina short, rarely nearly as long as, usually much shorter than, its forks *generosus* Wilkinson.

5. Ovipositor distinctly curved upwards, fully as long as the whole abdomen. (Sp. with at least the lateral lobes of the mesonotum blackened) *curvicaudis* Ratz.

–. Ovipositor more or less straight, not longer than the gaster . . . . . . 6.

6. Mesonotum blackish, somewhat depressed in front, sloping very gradually to the pronotum; fore-wing with hardly a trace of fasciation *brevicaudis* Ratz.

–. Mesonotum almost always bright reddish, at most a faint darkening along outer side of lateral lobes, not depressed in front and falling almost vertically to the pronotum; fore-wings conspicuously fasciated *rubidus* Rossi.

Spathius exarator Linn.

**Ichneumon exarator* Linn., 1758, *Syst. nat.* : 564, Col. 10a 1, no. 35.
**Ichneumon mutillarius* Fab., 1775, *Syst. Ent.* : 342, no. 82.
**Ichneumon mystacatus* Schrank, 1781, *Enum. Ins. Austr.* : 369, no. 746.
**Ichneumon innaturus* Grav., 1807, *Vergl. Übersicht zool. Syst.* : 261, no. 3758.
Cryptus clavatus* Panz., 1809, *Fauna Insect. German.* **9 : 102, F. 15.
Ichneumon attenuator* Thunb., 1822, *Bull. Acad. Sci. St. Petersb.* **8 : 260.

♀. Yellowish-brown; often marked with darker brown; this usually occurs on the lateral lobes of the mesonotum and on the gaster; in some forms the propodeum appears paler to the naked eye than does the rest of the dorsal surface of the thorax. Legs on the whole much the same colour as the thorax but all the tibiae pale at base; hind tibiae whitish-yellow on about basal $\frac{1}{3}$; distal to this is a small dark cloud on the upper surface which may sometimes form a band. Palpi yellowish. Fore-wings faintly fasciated.

Head : Face rather weakly transversely striated. Frons transversely striated or rugose-striate. Vertex completely smooth. Antenna with 32–41 segments; flagellum 1 as long as scape plus pedicel; hairs of the more basal segments of the flagellum pale and inconspicuous. Ocelli virtually in an equilateral triangle.

Thorax : Pronotal keel widely fused with the posterior margin of the pronotum, rarely merely contiguous with it in the middle; lateral area moderately well defined. Mesonotum sloping somewhat abruptly to the pronotum, the sculpture of its lobes in far greater part fine; posterior depression deep, the lateral lobes rather abruptly declivous on their inner side; posterior carinae usually broken and irregular; hairs sparse, semi-recumbent, concentrated along the margin of the notaulices. Scutellum feebly convex, varying from being scaly-reticulate to almost smooth. Areation of the propodeum very weak; basal carina varying between being considerably shorter and considerably longer than its forks; areola on the whole poorly delimited. Mesopleural furrow foveolate; disc more or less completely smooth; subalar impression without pubescence. Hairs of the upper surface of the hind tibia hardly more than half its middle width; apical lobe with 4–5 spines; hind tarsus 1 a little more than twice 2 (44 : 19); 3 as long as 5.

* As *Spathius exarator* is such a well-known species, I have given the synonymy generally accepted by earlier writers; I have not seen the types of any of the species concerned.

Abdomen : Petiole fully twice as long as the propodeum, striate-reticulate, the striate element not conspicuous except towards apex; tergite (2 + 3) with a sharply delimited sculptured area occupying about basal half; the sculpture consists of fine striate-punctation, though the striate element is decidedly weak and where it is weakest the sculpture often has a scaly appearance; gaster otherwise smooth and shining. Ovipositor sheaths about as long as the whole body.

♂. Like the female except for the sexual differences.

Length : ♂, 3–6 mm.; ♀, 4–7 mm., without ovipositor.

EUROPE; Generally distributed. JAPAN ? (*Watanabe*).

Hosts :—*Anobium striatum* Ol., *Anobium pertinax* L., *Ptilinus pectinicornis* L., *Hylesinus fraxini* Fabr., *Cryphalus tibiae* Panz., and *Eccoptogaster scolytus* F.

Spathius generosus Wilkinson.

Spathius generosus Wilkinson, 1931, *Bull. ent. Res.* **22** : 263, ♂♀.

This species is certainly very closely allied to *exarator*. Besides differing from it by the characters given in the key, it has the petiole shorter, stouter and more curved at the base when seen from the side. As in *exarator*, the hind tibiae have a dark medial band, though it seems to vary in intensity of colour. The gaster has a less flattened appearance; its integument is perhaps thicker and at base of tergites 4–6 there are traces of fine punctation.

INDIA : Chakrata, Deoban Range " ex pole of *Cedrus deodara* ", bred in association with *Scolytus major* Stebbing (SCOLYTIDAE).

Type in the British Museum (Natural History).

Spathius erythrocephalus Wesmael.

Spathius erythrocephalus Wesm., 1838, *N. Mém. Acad. Sci. Brux.* **11** (2) : 131.

The insect which I here interpret as Wesmael's species seems to me to be more closely related to *exarator* than to the *rubidus* sub-group. From *rubidus* Rossi, *curvicaudis* Ratz. and *brevicaudis* Ratz., it differs at once in the extent of the pale colour at the base of the hind tibiae and in having tergite (2 + 3) smooth, or virtually so. It may be compared with *exarator* as follows :—

♀. Head and thorax medium brown, the pronotum sometimes contrasting paler; petiole pale brownish-yellow, paler than the gaster which is much the same colour as the thorax. Hind tibiae pale yellowish on nearly basal half; in two out of the five females studied, the hind tibiae are very faintly (hardly noticeably) darkened at middle above. Antenna with 28–29 segments (2 ♀♀).

Pronotal keel less distinct, hardly developed but apparently fused in the middle with the posterior margin of the pronotum. Posterior depression of the mesonotum not so deep, the lateral lobes not at all abruptly declivous on their inner side. Scutellum feebly scaly-reticulate. Basal carina of the propodeum much longer than its forks.

Petiole shorter and in profile markedly elbowed at base (fig. 15). Tergite (2 + 3) completely smooth in 4 ♀♀; but in the 5th with very faint traces of striation on each side at base. Ovipositor sheaths as long as, or only a little shorter than, gaster plus petiole.

Length : 2·7–3·8 mm. without ovipositor.

♂. Unknown to me.

Specimens examined :—EUROPE : Austria, Tyrol, Oberau, 1 ♀; England, Monmouthshire, Govilon, 1 ♀ (Marshall Coll.; labelled " *rubidus* " by Marshall) [this ♀ is figured]; ?Denmark, 3 ♀♀.

Hosts :—*Spathius erythrocephalus* of authors has been bred from *Ochina ptinoides* Marsh. (ANOBIIDAE).

The essential features of this species as I accept it, are the size of the pale area on the hind tibiae and the smooth first segment of the gaster.

Spathius rubidus Rossi.

Spathius rubidus Rossi, 1794, *Mant. Ins.* **11** : 110, App. n. 88.

♀. Head entirely reddish; the mesonotum more or less evenly reddish with at most a faint darkening along the outer side of the lateral lobes; rest of the thorax reddish but tending to become darker towards the posterior end; petiole and gaster brownish but the former often nearly as red as the thorax. Antennae reddish-yellow on nearly basal half. Palpi dirty yellow, sometimes decidedly. Legs usually predominantly reddish throughout though the hind femora may have a decidedly brownish tint; hind tibiae often darkened and sometimes almost blackish but the basal $\frac{1}{6}$ –$\frac{1}{4}$ always pale, more or less colourless.

Head subcubical, not narrower behind the eyes than across them. Face very feebly striate-punctate. Frons finely striate. Ocelli in a triangle with base much longer than sides. Antenna with 26–30 segments (11 ♀♀), usually 28; flagellum rather thick, its vestiture very short, the hairs on the more basal segments considerably shorter than the middle width of the segments; flagellum 1 as long as scape plus pedicel.

Thorax: Pronotal keel very indistinct, but widely fused with the posterior margin of the pronotum. Mesonotum rather strongly arched in front, falling almost vertically to the pronotum, its hairs semi-recumbent, very sparse, restricted more or less to the course of the notaulices; lobes in far greater part scaly-reticulate; posterior carinae distinct but rather feeble. Scutellum almost flat, scaly-reticulate. Basal carina of the propodeum about as long as its forks or longer; dorsal areas on the whole very finely sculptured. Mesopleural furrow short, closely but feebly costate; disc more or less smooth. Hairs of the upper surface of the hind tibia much shorter than the width of the tibia, almost recumbent; apical lobe with a row of about 6 spines; hind tarsus 1 twice 2; 3 as long as 5. Wings: 2nd abscissa of the radius as long as or even a little longer than the 1st intercubitus; recurrens received into the 2nd cubital cell at a distance from the 1st intercubitus equal to fully $\frac{2}{3}$ its own length.

Abdomen: Petiole short and broad, its epipleura reaching to half or nearly so, but decidedly variable in this respect (fig. 14). Tergite (2 + 3) with an ill-delimited basal area of striate-reticulation, often vague and indistinct; this area occupies rather less than basal half; the apical part of the segment sometimes shows faint traces of sculpture. Ovipositor sheaths a little shorter than the gaster, or, less often, as long as this.

Length: 2·8–3·5 mm. without ovipositor.

♂. I have seen no male which I could with confidence associate with the female.

Specimens examined:—EUROPE: England; Germany; France; ?Denmark. MEDITERRANEAN REGION: Cyprus; Morocco.

Hosts:—*Spathius rubidus* of authors has been recorded from the following beetles:—*Phloeotribus scarabaeoides* Bern., *Scolytus intricatus* Ratz., and ?*Ernobius longicornis* Sturm.

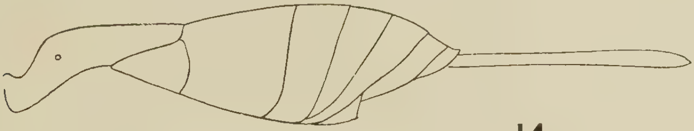
Important for the recognition of this species as I have interpreted it are (1) colour of mesonotum, (2) extent of pale colour at base of hind tibiae and (3), but to a less extent, the length of the ovipositor.

Spathius curvicaudis Ratzeburg.

Spathius curvicaudis Ratz., 1844, *Ichneum. Forstins.* **1** : 49, no. 2.

This species is extremely closely related to *rubidus* (m.), from which it differs as follows:—

♀. Thorax rather variable in colour; in middle European examples at least the lateral lobes of the mesonotum and the scutellar region are darkened, while the propodeum and metapleura frequently remain pale, sometimes almost yellowish and contrasting sharply with the darkened anterior part of the thorax; but sometimes the propodeum and metapleura are hardly paler than the rest of the thorax; in three females from the Mediterranean region (Cyprus and Morocco), the entire thorax and petiole are more or less uniformly reddish; except in the female from Morocco, the gaster tends to be darker in colour than in *rubidus*, more or less blackish. Fore-wings more strongly fasciated, the hyaline fascia at the stigma and the pale apex of the wing standing out more.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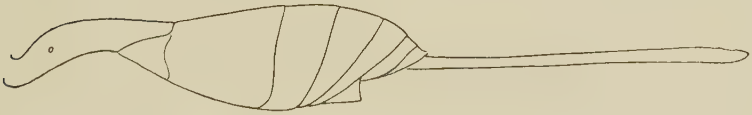
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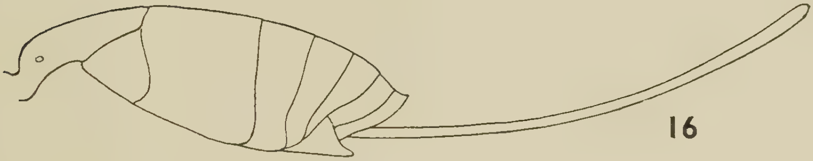
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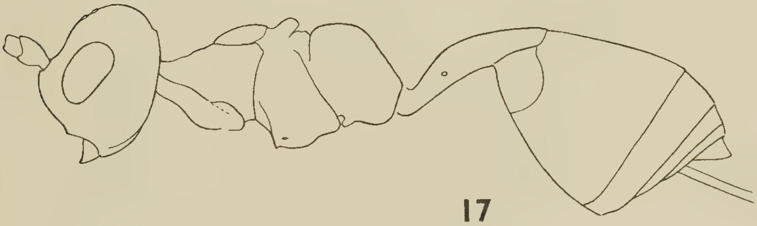
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FIGS. 14–17.—14. *Spathius rubidus* Rossi, abdomen, ♀; 15. *S. erythrocephalus* Wesmael, abdomen, ♀; 16. *S. curvicaudis* Ratzeburg, abdomen, ♀; 17. *S. pedestris* Wesmael, body, ♀.

Face more strongly sculptured. Antenna with 25–33 segments; 25 (1 ♀, Morocco); 28–29 (2 ♀♀, Cyprus); 30 (1 ♀, middle Europe); 32 (2 ♀♀, middle Europe); 33 (3 ♀♀, middle Europe).

2nd abscissa of the radius always markedly shorter than the 1st intercubitus; radius leaving stigma nearer apex.

Ovipositor distinctly curved upwards (fig. 16), its sheaths as long as, or a little longer than, the whole abdomen (Ratzeburg says " etwas kürzer ").

♂. Unknown to me.

Specimens examined :—Europe : France, 3 ♀♀; Germany, Dessau, 1 ♀; Germany, Saxony, Tharandt, 1 ♀, labelled "ex *Agrilus elongatus*"; Italy, Piedmont, Quart b. Aosta, 1 ♀; Kawak (? Turkey), 1 ♀.

This is certainly the species which Fahringer (1930) considered to be *curvicaudis.* He states that it is a parasite of *Agrilus* species and mentions that Reinhard bred a female from *Agrilus biguttatus* F. in 1864.

Spathius curvicaudis Ratz. seems to be very distinctive on account of the long curved ovipositor. Forms in which the propodeum is pale and the rest of the thorax, above, dark, are very striking to the naked eye.

Spathius brevicaudis Ratzeburg.

Spathius brevicaudis Ratz., 1844, *Ichneum Forstins.* **1** : 49, no. 1.

Ratzeburg's description is mostly concerned with colour but he also gives the length of the ovipositor and says that the wings are "sehr wenig trübe". He also says that his species is "im ganzen den vorigen (*exarator*) in den Verhältnissen ähnlich", from which it might reasonably be assumed that *brevicaudis* has a smooth vertex and sculpture on tergite (2 + 3). I have one female which fits his description very well and I propose to accept it as his species. It may be briefly described as follows :—

♀. Head rather dark brown but slightly paler (with a reddish tint) below. Thorax rather strikingly bicoloured, being reddish except that the mesonotum, scutellum and postscutellum are dark brown; petiole reddish; gaster medium brown. Palpi brownish. Antennae almost yellowish on about basal half. Legs entirely reddish, except that the apical tarsal segment of all legs is blackened and the hind tibiae are indistinctly pale at extreme base. Fore-wings very faintly darkened beneath the stigma.

Head of the usual form. Face weakly rugulose with very feeble transverse elements. Vertex virtually smooth; at × 60, there is the faintest indication of rugosity in places. Frons with very fine aciculation, widely interrupted along the middle. Ocelli in a triangle with base very slightly longer than sides. Antenna with 28 segments.

Pronotal keel indistinct but medially narrowly fused with the posterior margin of the pronotum. Mesonotum not depressed posteriorly; sloping gradually to the pronotum, its middle lobe not at all gibbose in front and somewhat depressed here; the lobes, especially the middle one, somewhat loosely scaly-reticulate (this effect may be the result of the dark background); posterior carinae feeble and much broken. Basal carina of the propodeum as long as its forks. Recurrens received into the 2nd cubital cell at a distance from the 1st intercubitus equal to fully $\frac{2}{3}$ its own length. Apical lobe of the hind tibia with a complete row of 6 spines.

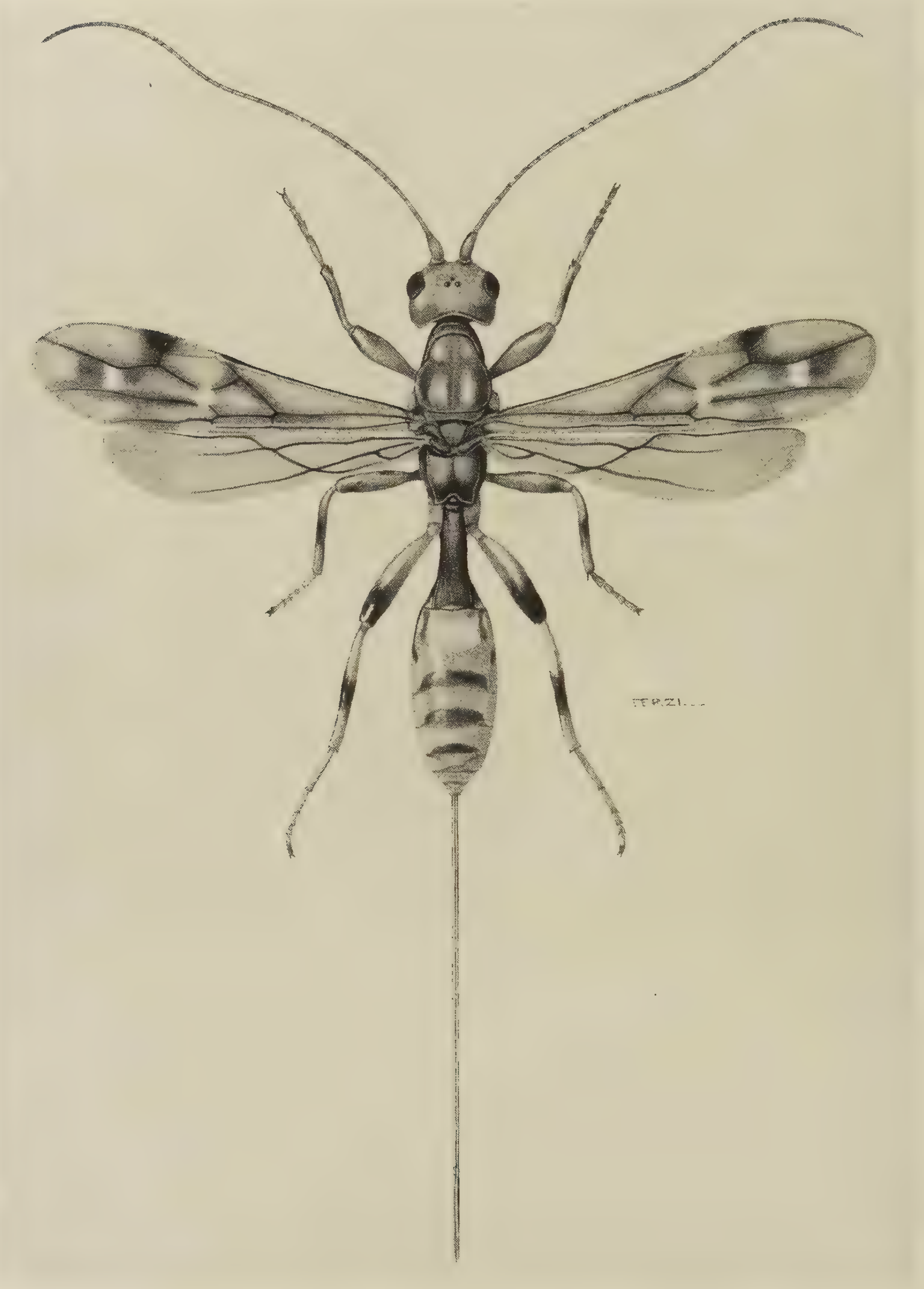
Petiole short and broad, its epipleura reaching nearly to half. Tergite (2 + 3) with a well-defined (probably individualistic) area of coarse scaly-reticulation at base; beyond this area the surface is very faintly roughened but the broad apical margin is smooth. Ovipositor sheaths a little shorter than the gaster.

Length : 2·8 mm. without ovipositor.

Europe : Sweden, Röstanga, 4.vii.1938, 1 ♀ (*D. S. M. Perkins & J. F. Perkins*). I also refer to this species a female, presumably from Denmark, in which the thorax and petiole are entirely blackish.

In structure this species is extremely like *rubidus* but differs from it in the colour and shape of the mesonotum, and the absence of dark fasciae to the fore-wings; it is also a less stoutly built species than *rubidus.*

For *brevicaudis* of authors, Fahringer (1930) gives the following hosts :— *Magdalis violacea* L., *Pissodes notatus* Fabr., *Carphoborus minimus* Fabr.,



ENGRAVED BY STAR ILLUSTRATION, LONDON.

Spathius moderabilis Wilkinson.—*Female.*

Myelophilis piniperda L., *Eccoptogaster rugulosus* Ratz. Ratzeburg bred the species from *Hylesinus minimus*.

Spathius pedestris Wesmael (fig. 17).

Spathius pedestris Wesm., 1838, *N. Mém. Acad. Sci. Bruxelles* **11** : 132, ♀.
Spathius apterus Wollaston, 1858, *Ann. Mag. nat. Hist.* (3) **1** : 24, ♀.
Spathius apterus Woll., Wilkinson, 1931, *Trans. ent. Soc. Lond.* **79** : 510.

This is a most distinctive species and may briefly be characterised as follows :—

♀. Pale brownish-yellow with the gaster contrasting darker brown. Hind tibia pale on about basal $\frac{1}{6}$.

Frons virtually smooth. Ocelli in a triangle which is almost equilateral. Antenna with 22–24 segments; the basal segments as in *rubidus*. Eyes rather small (fig. 17).

Mesonotum only a little longer than pronotum, about 6 : 5, small, the lobes scaly-reticulate; notaulices wide, made up of shining foveae. Scutellum somewhat conically produced posteriorly; in profile it shows as a rounded protuberance. Propodeum rather prominently roundly convex, its areolation feeble. Legs as in *rubidus*.

Ovipositor sheaths about as long as the whole abdomen.

Length : 2–3·5 mm.

Specimens examined :—Europe : Denmark, numerous examples; Germany, 3 ♀♀; France, 1 ♀; Albania, 1 ♀. Madeira : 2 ♀♀ (*apterus* Woll.).

Hosts : *Anobium striatum* Ol., *Gastrallus laevigatus* Ol., and the drug-store beetle, *Stegobium paniceum* L. (formerly *Sitodrepa*).

This little species is beyond doubt a member of the *exarator* group and is probably closely related to *rubidus* Rossi.

Group of *moderabilis* Wilk.

Spathius moderabilis Wilkinson.

S. moderabilis Wilk., 1931, *Trans. ent. Soc. Lond.* **79** : 518, ♂♀.

A strikingly coloured species, more especially in the female sex, being variegated with brown and testaceous-yellow Plate 5).

♀. The pronotum is more or less brown except within the postero-dorsal corner; within the subalar impression of the mesopleura is an oblique brown band and a brown band embraces the mesopleural furrow; the underside of the gaster is predominantly brown. All the coxae and pale parts of the legs decidedly yellowish, more so than the pale parts of the thorax.

Head approaching a subcubical condition, as wide behind the eyes as across them, or sometimes even a little wider. Face with very fine shining striation on a scaly-reticulate ground sculpture. Frons closely, wrinkly striate everywhere. Vertex with close, rather fine slightly wrinkly striation overlaid with weak scaly-reticulation, giving a rugose effect; on the temples towards the eyes the striation tends to fade out and the scaly-reticulation then predominates. Antenna with 33–39 segments (3 ♀♀); flagellum 1 shorter than scape plus pedicel; pubescence of at least the more basal flagellar segments inconspicuous, the hairs shorter than the width of the segments. Ocelli placed far forward on the vertex, the all-over width between the posterior ocelli clearly shorter than the distance between one of them and the eye-margin, 4 : 5.

Thorax : Pronotal keel not developed; lateral area only very feebly delimited. Mesonotum strongly gibbose in front, with rather prominent "shoulders", falling almost perpendicularly to the pronotum; lobes in far greater part subscaly-reticulate, almost shagreened; the notaulices converge on to a deep sunken area filled with more or less longitudinal rugosities, no two of which are differentiated to form the posterior carinae;

the lateral lobes are rather strongly longitudinally convex and slope somewhat abruptly on their inner side; mesonotal hairs quite inconspicuous, very sparse, recumbent and restricted more or less to the course of the notaulices. Scutellum feebly convex, scaly-reticulate, its anterior depression with many weak, broken costae. Propodeum: basal carina distinct to about middle; areola undefined, its position covered by a zone of close rugose-reticulation; area petiolaris sharply defined, semi-circular. Mesopleural furrow rather wide, evenly costate; disc covered with feeble rugosities. Wings (pl. 1); radius leaving stigma far beyond middle (fig. 18). Hind coxa with a feeble projection beneath; hairs of the hind tibia extremely short, adpressed, much shorter than the width of the tibia; hind tarsus 1 a little more than twice 2, 11 : 5; 3 about $\frac{2}{3}$ of 5, 7 : 10.

Abdomen: Petiole nearly twice as long as the propodeum, in profile not angled at base, finely and very confusedly wrinkled all over. Tergite (2 + 3) with a basal area of fine punctate-reticulation; apical part of the tergite with a large area of similar sculpture but finer and less even; this latter zone is separated from the basal area by a smooth very narrow space; rest of the gaster smooth. Ovipositor sheaths as long as the whole body.

Length: 4–6·5 mm. without ovipositor.

♂. The 2 males available are small, 2·5 and 3·5 mm., and are more or less uniformly yellowish in colour; the darkened area at the apex of tergite (2 + 3)–5 is clearly marked though faint.

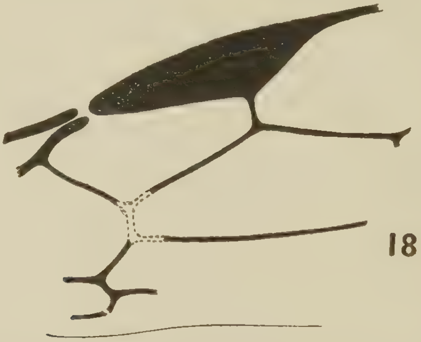


Fig. 18.—*Spathius moderabilis* Wilkinson, part of fore-wing, ♀.

Madeira.

In general facies this species resembles the common European *exarator* L. rather closely and in spite of some striking points of difference may perhaps be more closely related to it than to any other species described in this revision. Significant resemblances are :—shape of head, form of the mesonotum (prominent anterior lobe and convex lateral lobes), short hairs of the upper surface of the hind tibia, sharply delimited zone of sculpture at the base of tergite (2 + 3) and long ovipositor. Apart from colour, the chief differences are :—sculptured vertex of *moderabilis* and position of radius where it leaves the stigma; this last character makes the species a very striking one.

Group of *fasciatus* Walker.

This is a large heterogeneous assemblage in which it is possible to detect a number of subgroups. Many of the species are very closely related to each other and difficult to separate. Further study is certainly necessary in order to crystallise the identity of some of the forms; but investigation will have to be carried out on the basis of more material than I have had before me.

Characters: Species of very generalised appearance, on the whole. Colour very variable, usually reddish or pale brownish-yellow but rarely entirely black (cf. *cyclops* sp. n.).

Head varying much in shape as seen from above, often strongly transverse and much narrowed towards the occipital margin (the shape of the head, from this view, is extremely important for the determination of the species). Vertex sculptured or smooth. Infraclypeal cavity nearly circular, less than twice as wide as long, the tentorial pits at most a little further from each other than either is from an eye (it is extremely important to appreciate the significance of this character if confusion with the group of *alipes* is to be avoided). Pronotal keel seldom widely free and strongly developed (*erymanthus* sp. n.); usually feebly developed and medially widely fused with the posterior margin of the pronotum. Hind coxa almost always with a dentiform projection at base beneath. Forewings almost always evenly tinted to the naked eye (in *bion* sp. n., there is some indication of fasciation); 1st and 2nd abscissae of the radius never forming exactly a straight line as is usual in the group of *alipes*; 2nd abscissa of the radius never longer than the 3rd, usually only a little longer than the 1st transverse cubitus. Gaster always smooth; at most, and extremely rarely, a trace of longitudinal striation on each side at extreme base. Ovipositor variable in length, usually considerably shorter than the body.

AFRICA. INDO-AUSTRALIAN REGION. Fifty-eight species; one subspecies and two varieties.

Key to the species of the *fasciatus*.—Females.

(For European spp., see group of *exarator*, p. 197.)

1. African and Madagascan species . . . . 2.
–. Indo-australian species . . . . 4.
2. Hind legs dark brown throughout; hind coxa simple at base beneath *merope* sp. n. (p. 211).
–. At least the hind trochanters and the base of the hind tibiae whitish-yellow; hind coxa with a small projection at base beneath . . . . 3.
3. Thorax entirely reddish; hind femora reddish throughout *rufithorax* Szepligeti (p. 211).
–. Thorax almost entirely blackish; hind femora pale yellowish at base *elymus* sp. n. (p. 212).
4. Vertex smooth . . . . 5.
–. Vertex rugose, at least in places . . . . 27.
5. Petiole very long and narrow, at least twice as long as the propodeum (fig. 23); (slender spp., with the ovipositor nearly as long as the whole body) . . . . 6.
–. Petiole shorter, at most $1\frac{2}{3}$ as long as the propodeum . . . . 9.
6. Petiole in profile strongly widened at the spiracles, its upper edge strongly curved here (fig. 22); segment 1 of the hind tarsus with a smooth shallow channel along its upper surface . . . . . . *hebrus* sp. n. (p. 213).
–. Petiole in profile not or hardly widened at the spiracles, its upper edge at most slightly curved here; segment 1 of the hind tarsus simple . . . 7.
7. Head and thorax entirely pale fulvous yellow . . . . 8.
–. Head and thorax in far greater part brownish. (Sp. with the propodeum reddish, paler than the rest of the thorax.) . . . *daedalus* sp. n. (p. 215).
8. Bristles of the ovipositor sheaths very short and dense; 2nd abscissa of the radius considerably longer than the 1st intercubitus *carinus* sp. n. (p. 216).
–. Bristles of the ovipositor sheaths long, sparse; 2nd ab. of the radius not longer than the 1st intercubitus . . . . . *naupactus* sp. n. (p. 237).

9. Mesonotum thickly hairy all over, often long and short hairs mixed . . 10.

—. Mesonotum with only long, sparse hairs . . . . 20.

10. Large spp., about 8 mm. without ovipositor; hind femora deep cherry red; all the tibiae blackened except at apex. (Spp. with the apical lobe of the hind tibia showing a conspicuous row of 7 spines) . . . . 11.

—. Smaller spp., at most 5 mm. without ovipositor sheaths; hind femora and hind tibiae never thus coloured . . . . 12.

11. Thorax, petiole and hind coxae more or less black . *gentius* sp. n. (p. 249).

—. Thorax, petiole and hind coxae more or less cherry red *gentius* var. *unicolor* var. n. (p. 250).

12. Ovipositor sheaths not or hardly longer than the gaster . . . . 13.

—. Ovipositor sheaths considerably or much longer than the gaster . . . 15.

13. Mesonotum falling almost perpendicularly to the pronotum; pronotal keel medially fused with the posterior margin of the pronotum. (Sp. with the mesonotum tawny yellow and the propodeum reddish) *seres* sp. n. (p. 232).

—. Mesonotum sloping very gradually to the pronotum; pronotal keel free. (Spp. with the thorax entirely yellowish-red; scape and pedicel dark brown contrasting with the pale head) . . . . 14.

14. Hind coxae infuscated; head without a brown patch behind each eye; frons smooth. . . . . *eridamus* sp. n. (p. 247).

—. Hind coxae pale yellow; head with a brown patch behind each eye; frons with traces of delicate striation . . . . *metris* sp. n. (p. 249).

15. Hind coxa without a trace of a dentiform projection at base beneath group of *tityrus* (part) (p. 303).

—. Hind coxa with a distinct, even if small, dentiform projection at base beneath . . . . 16.

16. Mesonotum entirely black. (Sp. with the hind tibiae brownish, pale at extreme base; disc of the mesopleura smooth, polished) *alcine* sp. n. (p. 234).

—. Mesonotum fulvous or reddish at least in part . . . . 17.

17. Disc of the mesopleura with some sort of sculpture everywhere; propodeum black; ovipositor sheaths not longer than gaster plus petiole. (Sp. with the mesonotum dull reddish) . . . . . . *elagabalus* sp. n. (p. 232).

—. Disc of the mesopleura polished and virtually smooth; propodeum not black; ovipositor sheaths clearly longer than gaster plus petiole . . 18.

18. Hind coxae pale yellow . . . . *artabazus* sp. n. (p. 233).

—. Hind coxae in greater part infuscated . . . . 19.

19. Lateral lobes of the mesonotum more or less evenly shagreened *nearchus* sp. n. (p. 230).

—. Lateral lobes of the mesonotum with a fine more or less striate sculpture extending to middle . . . . *nearchoides* sp. n. (p. 231).

20. Hind tibiae dark brown throughout; vertex yellowish, the rest of the head reddish-brown . . . . *leptothecus* Cam. (p. 222).

—. Hind tibiae with at least a yellowish post-basal area; head differently coloured . . . . 21.

21. Large sp., 6 mm. without ovipositor, deep wine red in colour. (Sp. with the mesonotum with much coarse shining rugosity; ovipositor sheaths nearly as long as the whole body; hairs of the mesonotum rather short) *eclectes* sp. n. (p. 251).

—. Smaller spp., at most 5 mm. without ovipositor and then the body is mostly yellowish-brown . . . . 22.

22. Pronotal keel free; costae of the mesopleural furrow spreading upwards as obsolescent carinae all over the disc. (Sp. entirely pale, fulvous red except for a dark blotch on tergite (2 + 3); petiole nearly twice as long as the propodeum; ovipositor sheaths much longer than gaster plus petiole) . . . . *erymanthus* sp. n. (p. 263).

—. Pronotal keel medially fused with the posterior margin of the pronotum or at any rate narrowly touching it medially; costae of the mesopleural furrow not extending beyond its limits, the disc more or less smooth . . . . 23.

23. Ovipositor sheaths not or only a little longer than gaster plus petiole . . . 24.

—. Ovipositor sheaths much longer than gaster plus petiole *athesis* sp. n. (p. 222).

24. Hind tibiae pale honey-yellow throughout; recurrens of the fore-wing received into the 2nd cubital cell at a distance from the 1st transverse cubitus equal to nearly half its own length . . . . 24a.

—. Hind tibiae at least very faintly darkened in the middle; recurrens almost interstitial . . . . 25.

24a. Hairs of the upper surface of the hind tibia semi-erect, not longer than its middle width; hind femora hardly infuscate towards apex *fasciatus* Walker (p. 237).

—. Hairs of the upper surface of the hind tibia virtually erect, fully twice as long as its middle width; hind femora strongly infuscate towards apex on each side . . . . *moscus* sp. n. (p. 236).

25. Hind tibiae brownish with a pale post-basal area. (Sp. with the scutellar shield entirely and the dorsal areas of the propodeum in far greater part, smooth and shining; mesonotum obscurely reddish; apical lobe of the hind tibia with 4 spines) . . . . *neleus* sp. n. (p. 235).

—. Hind tibiae in greater part yellowish, faintly darkened in the middle; if the scutellum and dorsal areas of the propodeum are somewhat shining, then the apical lobe of the hind tibia has only 2 spines . . . . . . 26.

26. Lateral lobes of the mesonotum with coarse rugosity which leaves free only a narrow, linear zone of surface sculpture (apical lobe of the hind tibia with 2 spines) . . . . *psammenitus* sp. n., var. *levis* n. (p. 218).

—. Lateral lobes of the mesonotum with less raised rugosity and a much greater area of fine surface sculpture. (Sp. with the dorsal areas of the propodeum dull, scaly-reticulate where no raised rugosity occurs) *asander* sp. n. (p. 227).

27. Cheeks strongly and coarsely rugose. (Large sp., *c.* 7 mm. without ovipositor; virtually black to the naked eye and with the ovipositor as long as the gaster; antenna with 41 segments, of which 30–34 are deep yellow) *cyclops* sp. n. (p. 256).

—. Cheeks entirely or almost entirely smooth and shining; at most there is a trace of rugosity against the occipital margin . . . . 28.

28. Antenna 27–28-segmented. (Sp. with the upper part of the head pale yellow or dirty yellow; propodeum with conspicuous dentiform protuberances posteriorly; hind femora brown throughout) . . . *bion* sp. n. (p. 264).

—. Antenna with not less than 33 segments or broken . . . . 29.

29. Petiole very long and narrow, about 2½ times as long as the propodeum, beyond the spiracles highly polished, the rugosities almost smoothed out. (Spp. with about the anterior half of the vertex coarsely sculptured; disc of the mesopleura everywhere deeply scored by strong sulcation; hind femur reddish or brownish but not paler at base; recurrens more or less interstitial) . . . . subgroup of *dolopes* sp. n., 30.

—. Petiole of average length, rarely twice as long as the propodeum, clearly with some kind of sculpture all over . . . . 32.

30. Mesonotum clothed everywhere densely with fine very short pubescence; ridge separating the area petiolaris from the areola unusually prominent, lamelliform; ovipositor sheaths very obviously shorter than the body *busirios* sp. n. (p. 245).

—. Mesonotum at least over most of its medial part clothed only with outstanding hairs; ridge separating these two areas merely well developed but not prominent nor lamelliform; ovipositor sheaths not or hardly shorter than the body . . . . 31.

31. Entire body deep brown, almost black; all the femora brownish; hind tibiae yellowish at extreme apex; flagellum without pale apical segments *chersonesus* sp. n. (p. 244).

—. Entire body predominantly reddish; all the femora reddish; hind tibiae not yellowish at extreme apex; apical 10–16 segments of the flagellum whitish-yellow . . . . *dolopes* sp. n. (p. 242).

32. Pronotal keel separated from the posterior margin of the pronotum by a distinct space (doubtful cases will be found on both sides of the key) . . 33.

—. Pronotal keel either completely fused with the posterior margin of the pronotum medially or at least contiguous with it in the middle or sometimes very indistinct medially . . . . 42.

33. Hind tibiae darkened in the middle and with a post-basal whitish-yellow band (this differentiation is hardly marked in *butuanensis* subsp. n.). (Spp. with the basal carina of the propodeum much shorter than its forks) . . 34.

—. Hind tibiae uniformly honey-yellow to honey-brown. (Spp. with the recurrens received into the 2nd cubital cell at a distance from the 1st intercubitus equal to at least nearly half its own length (*butuanensis* is an exception) . . . . 37.

34. Mesopleura everywhere scored by deep sulcation; lobe of the hind tibia with 3–6 spines . . . . 35.

—. Mesopleura all over its medial part virtually smooth and polished; lobe of the hind tibia with only 2 spines. (Striation of the vertex very wrinkly; hind coxae reddish; darkening of the middle part of the hind tibia visible only in a dorsal view; hind tarsus brown) *colophon* subsp. *butuanensis* subsp. n. (p. 252).

35. Hind coxae pale yellow; head evenly reddish. (Spp. with the recurrens almost interstitial) . . . . 36.

—. Hind coxae brown; head somewhat yellowish with a brownish patch behind each eye, each of which patches are joined across the occiput to form an ill-defined brownish band . . . . *echemus* sp. n. (p. 247).

36. Vertex smooth on roughly posterior half, at most an indication of feeble foveae against the occipital margin; flagellum without yellow apical segments; middle lobe of the mesonotum with strong, on the whole regular and unbroken, rugae right across . . *cheops* sp. n. (p. 246).

—. Vertex on roughly posterior half with strong longitudinal rugae which merge into the transverse rugosities of the anterior half; flagellum with whitish-yellow apical segments; middle lobe of the mesonotum with its transverse rugae much broken up to form coarse rugose-reticulation, the transverse element only feebly indicated . . *drymus* sp. n. (p. 246).

37. Ovipositor a little longer than petiole plus gaster. (Spp. with the posterior declivous part of the vertex usually smooth, at most a trace of foveation against the occipital margin; middle lobe of the mesonotum coarse transverse rugae which leave free only a fine, indistinct line of ground sculpture on each side of the middle line) . . . . 38.

—. Ovipositor considerably or much shorter than petiole plus gaster, or, if nearly as long, then the posterior, declivous part of the vertex has characteristic longitudinal striation . . . . 39.

38. Posterior ridges of the mesonotum completely undefined, being lost in the surrounding coarse rugosity; postscutellum thickly pubescent; hind tarsus 4 in profile not longer than wide. (Head very strongly narrowed behind the eyes). . . . . *epaphus* sp. n. (p. 253).

—. Posterior ridges clearly defined as such; postscutellum with only a trace of pubescence; hind tarsus 4 clearly longer than wide, in profile. (Head much less narrowed behind the eyes) . . . . *colophon* sp. n. (p. 251).

39. At least the propodeum and the petiole blackish. (Spp. with the frons and vertex strongly and on the whole coarsely rugose; mesonotum with much

strong rugosity so that at least on the lateral lobes only a narrow linear zone of ground sculpture is left free) . . . . 40.

—. Propodeum and petiole reddish . . . . 41.

40. Ovipositor as long as the gaster; basal carina of the propodeum longer than its forks; posterior declivous part of the vertex merely with irregular somewhat obsolescent rugosity . . . . . *anytus* sp. n. (p. 258).

—. Ovipositor a little longer than the gaster; basal carina of the propodeum as long as its forks; posterior declivous part of the vertex almost always with strong longitudinal striation which merges into the coarse rugosity of the anterior part of the vertex . . . . . *aphareus* sp. n. (p. 257).

41. Hind coxae decidedly reddish all over; sculpture of the upper surface of the head consisting of transverse carinae which are wrinkly and much broken in large examples but become straight and even in smaller individuals; length: 3·2–4·2 mm. . . . . . . *gades* sp. n. (p. 255).

—. Hind coxae almost yellowish; sculpture of the upper surface of the head consisting of smooth, and on the whole regular, carinae which more or less circumscribe the ocelli; length: 5 mm. . . . *lynceus* sp. n. (p. 255).

42. Mesonotum densely clothed with short, more or less decumbent hairs. (Spp. having the hind tibiae with a pale postbasal band) . . . . 43.

—. Mesonotum clothed only with long, sparse, usually outstanding hairs; if not, then the hind tibiae not marked as above . . . . 45.

43. Head subquadrate, not narrower behind the eyes than across them; posterior ocelli situated anterior to middle of head as seen from above; flagellum 1 considerably longer than scape plus pedicel. (Pale brownish-yellow species with darker brown markings and an ivory white spot on each side of basal half of tergite (2 + 3)) . . *sabronensis* sp. n. (p. 240).

—. Head markedly transverse, clearly narrower behind the eyes than across them; posterior ocelli situated at middle; flagellum 1 at most a trifle longer than scape plus pedicel . . . . 44.

44. Darkened part of the hind femora reddish . *cavillator* Wilkinson (p. 238).

—. Darkened part of the hind femora blackish . . *japenensis* sp. n. (p. 240).

45. Posterior declivous part of the vertex with characteristic longitudinal striation. (Spp. with the hind tibiae more or less unicolorous) . . . 46.

—. Posterior declivous part of the vertex with at most a trace of striation here, taking the form of short longitudinal foveae against the occipital margin and then the hind tibiae are bicolorous . . . . 47.

46. Mesonotum entirely reddish; vertex at sides of the ocelli with coarse wrinkly rugosity . . . . *aphareus* sp. n. (p. 257).

—. Mesonotum in greater part black; vertex at sides of ocelli with fine striation . . . . *dolon* sp. n. (p. 259).

47. Ovipositor clearly or much shorter than the petiole plus gaster . . . 48.

—. Ovipositor at least about as long as these together . . . . 53.

48. Thorax entirely black. (Sp. with the sculpture of the vertex fine, quite indefinite) . . . . *ninus* sp. n. (p. 260).

—. At least the mesonotum and scutellum pale . . . . 49.

49. Hind coxae reddish . . . . *gades* sp. n., var. (p. 255).

—. Hind coxae yellowish . . . . 50.

50. Propodeum blackened or at any rate considerably darker than the mesonotum; gaster predominantly brownish . . . . 51.

—. Propodeum pale; gaster predominantly yellowish. (Unusually pallid species to the naked eye, the head almost with a greenish-yellow tint; vertex strongly, regularly, smoothly striated) . . . . 52.

51. Disc of the mesopleura dull, sculptured all over . *asclepiades* sp. n. (p. 229).

—. Disc of the mesopleura smooth and shining . . . *helle* sp. n. (p. 225).

52. Head with a brown patch behind each eye . . *proxenus* sp. n. (p. 223).

Head without such a patch . . . . *betremi* sp. n. (p. 224).

53. Hind femora brown virtually throughout . . . . 54.

—. Hind femora not brown . . . . 55.

54. Areola of the propodeum well defined; striation of the vertex somewhat obsolescent; mesonotal hairs more or less recumbent; hind tibiae pale on about basal half . . . . *japenensis* sp. n. (p. 240).

—. Areola completely undefined; striation of the vertex even all over; mesonotal hairs outstanding; hind tibiae pale on about basal third *tahitiensis* sp. n. (p. 265).

55. Hind femora red throughout. (Sp. with the vertex only feebly sculptured; lobe of the hind tibia with 5 spines; ovipositor about as long as the thorax plus abdomen) . . . . *periander* sp. n. (p. 221).

—. Hind femora pale at least basally or pale on upper surface and darkened laterally . . . . 56.

56. Thorax entirely black; head very short behind the eyes as seen from above, and strongly narrowed towards the occipital margin. (Sp. with the lobes of the mesonotum, apart from the foveolate notaulices, very shining and with a fine somewhat obsolescent ground sculpture; hind tibiae pale yellow throughout) . . . . *iphitus* sp. n. (p. 260).

—. Thorax rufous or with at least the mesonotum in greater part pale . . . 57.

57. Lateral lobes of the mesonotum in greater part very coarsely sculptured, the sculpture consisting of strong shining rugae, there being present only a narrow, rather sharply delimited longitudinal area of fine ground sculpture . . . . 58.

—. Lateral lobes of the mesonotum much less coarsely sculptured, the area occupied by fine ground sculpture wider and blurred in outline. (Small sp., 3·5–4 mm., without ovipositor; petiole rather strongly elbowed just behind the middle) . . . . *isocrates* sp. n. (p. 229).

58. Recurrens received into the 2nd cubital cell at a distance from the 1st intercubitus equal to nearly half its own length (that of recurrens). (Spp. with the vertex strongly sculptured on anterior half; hind tibiae unicolorous, pale, without a trace of a darker suffusion at middle) . . 59.

—. Recurrens received into the 2nd cubital cell at a distance from the 1st intercubitus equal to at most one-third of its own length. (Spp. with the vertex usually very feebly sculptured, or if more strongly, then the hind tibiae have at least a very faint cloud in the middle as seen from above) . 60.

59. Ovipositor sheaths a little longer than the whole abdomen; head without a brownish patch behind each eye; apical lobe of the hind tibia with 1 spine *colophon* sp. n. (p. 251).

—. Ovipositor sheaths as long as the whole abdomen; head with a brownish patch behind each eye; lobe of the hind tibia with more than 1 spine (probably 3–4) . . . . *leptoceras* Cameron (p. 252).

60. Vertex coarsely reticulate-rugose; mesonotum pale brownish-yellow with an oblong patch (brown) on each lateral lobe. (Sp. with the hind coxa clear yellow) . . . . *ares* sp. n. (p. 226).

—. Vertex at most merely transversely rugose and then the hind coxae are reddish; mesonotum rufous, unicolorous . . . . 61.

61. Lobe of the hind tibia with at most 2 spines; hind femur evenly narrowed from apex to base; hind coxae yellow. (Sculpture of the vertex decidedly weak) . . . . *psammenitus* sp. n. (p. 217).

—. Hind tibia with 3–4 spines; hind femur not evenly narrowed from apex to base; hind coxae brownish . . . . 62.

62. Vertex strongly transversely wrinkly-striate; hind tibiae brownish, whitish-yellow on basal third; disc of the mesopleura with strong sulcation more or less convergent on to the posterior fovea *polydectes* sp. n. (p. 220).

—. Vertex with a patch of weak sulcation on each side roughly behind each posterior ocellus; hind tibiae on the whole yellowish with a faint darkening above at middle; disc of the mesopleura in greater part smooth *poliorcetes* sp. n. (p. 220).

Spathius rufithorax Szepligeti.

S. rufithorax Szep., 1914, *Mitt. zool. Mus. Berl.* 7 : 192, ♀.

♀. Brown with reddish tint; the gaster dark brown but yellowish on ventral side beneath petiole. Palpi whitish-yellow. Front and middle coxae honey-yellow; hind pair reddish-brown; all the femora reddish-brown throughout; hind tibiae dark brown, but colourless at extreme base; hind tarsi brownish, the segments a little paler apically. Base of the stigma yellowish.

Head only a trifle narrower behind the eyes than across them, 13 : 14. Face with shining transverse rugosity. Frons closely striate all over. Vertex completely smooth. Ocelli in a triangle with base distinctly longer than sides. Antenna absent beyond the pedicel, but scape in no way unusual.

Thorax : Pronotal keel medially fused with the posterior margin of the pronotum; lateral area not defined. Mesonotum sloping rather gradually to the pronotum, its lobes in far greater part with a fine surface sculpture; the sides of the middle lobe, at the origin of the notaulices, show a few shining, transverse rugae; posterior carinae strongly developed but very irregular in outline; hairs long, sparse. Scutellum nearly flat, shining, virtually smooth, its anterior depression divided into 4 large foveae. Propodeum : basal carina about as long as its forks; dorsal areas ill defined, with shining transverse rugosities over most of their surface but becoming smooth anteriorly; areola with strong transverse ridges; area petiolaris separated from the areola by a ridge which is hardly emphasised; no trace of posterior protuberances. Disc of the mesopleura shining, more or less smooth; furrow rather narrow, slightly widened towards its posterior end, feebly costate. Legs : hind coxa with a well-developed dentiform projection; hind femur somewhat abruptly narrowed at base; hairs of the upper surface of the hind tibia almost twice as long as its middle width; apical lobe with 6 spines; hind tarsus 1 twice as long as 2; 3 almost as long as 5, 7 : 6; 4 is 1¾ times as long as wide. Recurrens of the fore-wing received into the 2nd cubital cell at a distance from the 1st intercubitus equal to about ⅓ its own length.

Abdomen : Petiole slender, decidedly constricted beyond middle, twice as long as the propodeum, longitudinally rugose but with a feeble reticulate element at about middle. Gaster virtually smooth; there is a band of excessively fine punctures on tergite (2 + 3) at about apical ⅔ and the epipleura of this tergite are extremely finely punctate. Ovipositor sheaths about as long as the abdomen plus propodeum.

Length : about 6·7 mm. without ovipositor.

AFRICA : Spanish Guinea, Alcu Benito Dist., 16–31.viii.1906, 1 ♀ (*G. Tessman*).

Type in Zoological Museum, Berlin.

The specimen on which the above description is based bears the label "*Spathius rufithorax* m." in Szepligeti's handwriting, and another with the full locality data as recorded by him. I regard this insect as the type even though it does not actually bear a type label.

This species seems to be fairly closely allied to *periander*, a Malayan species, resembling it in having a smooth vertex, unicolorous hind femora and dark hind tibiae with their colourless base. Differences between *rufithorax* and *periander* are the comparatively fine sculpture of the greater part of the mesonotum of *rufithorax*, the longer basal carina of the propodeum and the shorter ovipositor.

Spathius merope sp. n.

♀. Very dark brown, almost black to the naked eye. Mesosternum considerably paler than the rest of the thorax. Antennae unicolorous, medium brown throughout, for the 37 segments still existing. Front and middle coxae medium brown like the mesosternum; legs otherwise dark brown *throughout.* Two apical segments of the maxillary palpi yellowish; palpi otherwise brownish. Fore-wings decidedly brownish, with an ill-defined hyaline fascia cutting the base of the stigma.

Head distinctly a little narrower behind the eyes than across them. Face finely reticulate-rugose, with a well-marked transverse element. Frons finely, smoothly transversely striate. Vertex shining, almost smooth; there is just the merest trace of striation behind the ocelli and a patch of deeper striation between ocelli and eye-margin. Antenna broken but with at least 38 segments; flagellum 1 as long as scape plus pedicel, distinctly a little bent; hairs of the flagellum rather bristly, fully $\frac{3}{4}$ the width of the segments. Base of the ocellar triangle clearly longer than its sides.

Thorax: Pronotal keel not developed; lateral area not delimited but the depression is closely ribbed. Mesonotum somewhat gibbose in front, falling almost perpendicularly to the pronotum; lobes everywhere with a fine, more or less scaly reticulation; notaulices deep, closely costate, converging on to a deeply sunken area; this area is rather sharply confined and is filled with transverse rugosity; posterior carinae completely undeveloped; hairs extremely sparse, semi-recumbent. Scutellum feebly convex, somewhat dull, with weak scaly-reticulation, its anterior depression with about 7 weak, very irregular costae. Propodeum virtually unareated; a very feeble basal carina reaches to about middle; dorsal areas, as defined by the basal carina and the 2 lateral carinae, with a little scaly-reticulation at base; elsewhere, as is also the rest of the propodeum, covered with rather feeble and very irregular reticulation; area petiolaris delimited above by a strong ridge. Mesopleural furrow short, deep, closely but rather weakly costate; disc smooth and shining. Legs: hind coxa rounded beneath at base; hind femur and hind tibia slender; hairs of the upper surface of the hind tibia rather sparse, about as long as its middle width; apical lobe without spines; hind tarsus long, slender, segment 1 being twice as long as 2; 3 as long as 5 (figs. 89 and 90). Nervulus postfurcal by nearly its own length; recurrens received into the 2nd cubital cell at a distance from the 1st intercubitus equal to about one-third its own length; nervus parallelus more or less interstitial.

Abdomen: Petiole rather narrow, about $1\frac{1}{2}$ times as long as the propodeum; moderately rugose and, except in apical third, without longitudinal elements. Tergite (2 + 3) completely smooth except for the faintest traces of striation on each side at base; laterally without a trace of a differentiated margin. Ovipositor sheaths about as long as the whole abdomen.

Length: 5 mm. without ovipositor.

MADAGASCAR: 1 ♀ (*J. de Gaulle*, 1919).

Type in British Museum (Natural History).

An interesting species, perhaps not distantly related to *rufithorax* Szepligeti from West Africa, and differing at once from that species in several points, chief among which are:—colour of legs, simple hind coxa and sculpture of the posterior depression of the mesonotum. The entirely brown legs of this species are an unusual and characteristic feature.

Spathius elymus sp. n.

♀. Dark brown to the naked eye. Head medium brown; thorax dark brown to blackish, except that the propleura and broad anterior margin of the pronotum are paler, almost yellowish-brown; petiole brown, a little paler towards apex; gaster dark brown, sometimes paler at its articulation with the petiole. Antennae pale brownish-yellow towards base; at least 7 apical segments bright yellow. Palpi yellow. Legs predominantly honey-brown; hind coxae brownish; yellowish on about basal $\frac{1}{4}$ but not sharply so; hind tibiae pale brownish but yellowish on about basal $\frac{2}{5}$. Wings decidedly brownish; stigma obscurely yellowish on about basal $\frac{1}{3}$.

Head distinctly a little narrower behind the eyes than across them. Face very shining, with indefinite scaly-reticulation on each side of the feeble, almost smooth medial elevation. Frons more or less smooth except for a patch of feeble striation on each side of the anterior half. Vertex completely smooth. Base of the ocellar triangle slightly longer than its sides. Antenna broken but with at least 30 segments (type); to judge from the number of yellow apical segments, the total number of antennal segments would probably be between 31 and 34; flagellum 1 a trifle longer than scape plus pedicel, 6 : 5; hairs of the flagellum somewhat bristly, those on at least the 4 basal segments not longer than the width of the segments.

Thorax : Pronotal keel apparently not developed; lateral area poorly defined. Mesonotum falling almost perpendicularly to the pronotum, its hairs extremely sparse; lobes somewhat dull, everywhere evenly scaly-reticulate; notaulices shallow, very feebly costate; posterior carinae well defined, posteriorly anastomosed to form a single ridge without lateral branches; no other raised rugosities posteriorly. Scutellum almost flat, evenly scaly-reticulate. Areation of the propodeum by no means sharp, obscured by irregular reticulation; basal carina about as long as its forks; areola and area petiolaris confluent; dorsal areas anteriorly subscaly-reticulate. Mesopleural furrow long, weakly but rather closely foveolate; disc smooth, polished. Legs : hind coxa with a well-defined dentiform projection; hind femora rather narrow; hind tibia rather narrow, the hairs of its upper surface semi-erect, irregular in length, most of them not longer than the middle width of the tibia, but the longest of them about 1⅓ times as long; apical lobe with 1–3 inconspicuous spines; hind tarsus 1 twice 2; 3 almost exactly as long as 5, 13 : 14. Recurrens received into the 2nd cubital cell at a distance from the 1st intercubitus equal to fully ⅔ its own length; nervus parallelus not interstitial; only a very slight angle between the 1st and 2nd abscissae of the radius.

Abdomen : Petiole 1⅔ as long as the propodeum, striate-rugose; gaster smooth, shining. Ovipositor sheaths a trifle longer than gaster plus petiole.

Length : about 3 mm. without ovipositor.

S.W. AFRICA : Okahandja, 2–18.iii.1928, 2 ♀♀; 3–9.ii.1928, 1 ♀, type (*R. E. Turner*).

Type in British Museum (Natural History).

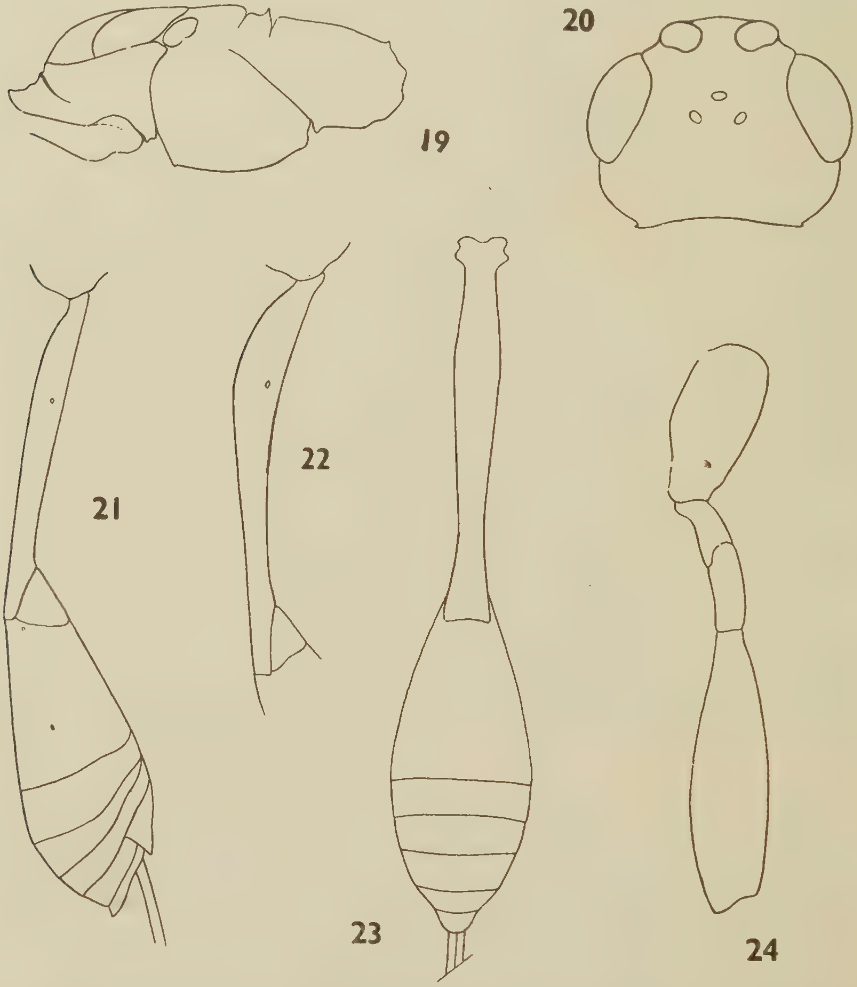
This is a feebly characterised species; important for its recognition are the sculpture of the face and mesonotum, and the short hairs of the upper surface of the hind tibia.

Spathius hebrus sp. n.

♀. Head brownish-red, becoming somewhat yellowish on face and cheeks; thorax virtually black, contrasting sharply with the pale head; anterior half of the pronotal collar almost as pale as the head; sides of the pronotum faintly reddened; petiole very dark brown, with a reddish tint; gaster reddish-brown, darker than the head but paler than the petiole. Pedicel brownish-red, somewhat yellowish on concave side; flagellum brown throughout but a little paler towards base. Hind coxae yellowish above but becoming faintly reddened beneath; hind femora embrowned almost throughout; hind tibiae honey-yellow, extremely faintly darkened in the middle; basal segment of the hind tarsi, base of the 2nd segment above and whole of the apical segment, brownish. Palpi whitish-yellow. Fore-wing evenly tinted; stigma pale on about basal third.

Head somewhat subquadrate, a little narrower behind the eyes than across them. Face with transverse, broken striation, weak and tending to disappear along the middle line. Frons smoothly and sharply striated. Vertex virtually smooth though, at ×60, there can be made out the faintest indication of sculpture. Ocelli arranged in a triangle the base of which is considerably longer than its sides. Antenna with 44 segments; flagellum as long as scape plus pedicel; hairs of the flagellum short, almost recumbent, not longer than the width of the segments.

Thorax : Pronotal keel somewhat weak but widely separated from the posterior margin of the pronotum ; lateral area moderately well defined. Mesonotum sloping only moderately abruptly to the pronotum, very shining, its lobes in greater part covered with a fine scaly-reticulate sculpture ; the lateral lobes show strong raised rugosity along each side but the rugae along the inner margin, *i.e.*, lateral prolongations of the few much winding carinae which cover the posterior depression, are covered with the prevailing ground sculpture ; posterior ridges hardly emphasised ; hairs of the mesonotum long and very sparse. Scutellum more or less flat, shining, closely scaly-reticulate and with two or three shallow, puncture-like impressions around sides. Propodeum : basal carina a little longer than its forks ; areola separated from the area petiolaris by a hardly emphasised ridge ; dorsal areas not sharply defined, and, except towards base, covered with strong rugae ; no trace of posterior protuberances. Mesopleura everywhere sculptured ; towards the



Figs. 19–24.—19. *Spathius carinus* sp. n., thorax, lateral, ♀ ; 20. *S. carinus*, head, dorsal, ♀ ; 21. *S. daedalus* sp. n., abdomen, lateral, ♀ ; 22. *S. hebrus* sp. n., petiole, lateral, ♀ ; 23. *S. hebrus*, abdomen, dorsal ; 24. *S. daedalus*, part of hind leg, ♀.

posterior corner of the disc, the rugae are coarse and irregular but towards the centre of the disc the sculpture becomes somewhat obsolescent. Legs: hind coxa with hardly more than a blunt angulation beneath at base; hind femur somewhat thick; hind tibia somewhat thick, the hairs of its upper surface all long, almost twice as long as the middle width of the tibia; apical lobe with 4 minute spines; fringe 2–3; hind tarsus 1 shallowly grooved along its entire upper surface, the resulting groove shining, more or less smooth, hairless and further emphasised by being paler in colour than the rest of the segment; hind tarsus 1 about $2\frac{1}{3}$ times as long as 2; 3 only half as long as 5. Recurrens of the fore-wing received into the 2nd cubital cell at a distance from the 1st intercubitus, equal to a little more than one-third of its own length; 1st and 2nd abscissae of the radius meeting at a well-defined though obtuse angle.

Abdomen: Petiole very long (fig. 22), almost 3 times as long as the propodeum, strongly constricted in apical half, as wide at extreme apex as across spiracles; the surface apical to the spiracles is very shining, and has only a somewhat obsolescent scaly-reticulation. Gaster narrowly ovate (fig. 23). Ovipositor sheaths about as long as thorax plus abdomen.

Length: 5 mm. without ovipositor.

BORNEO: Sandakan, 1 ♀, the type (*Baker*).

Type in U.S. National Museum.

This is a very interesting species and seems to have no close allies. Although in general appearance it shows no striking feature and is very much like the next species, yet the peculiar modification of the basal segment of the hind tarsus makes it unique among the forms included in this monograph. Specifically it is also very distinctive on account of the combination of the smooth vertex, long, narrow petiole, and shortness of the third segment of the hind tarsus.

Spathius daedalus sp. n.

In general facies and in the combination of smooth vertex and long petiole, this species resembles *hebrus*.

♀. Head brownish-red; apart from the propodeum, which is much the same colour as the head, and about anterior two-fifths of the pronotal collar, the thorax is dark brown with a reddish tint; petiole coloured like the propodeum and head but with a faint yellowish tint; tergite (2 + 3) pale brown on about basal two-thirds, otherwise nearly black. Front and middle coxae honey-yellow; hind coxae brownish; hind femora brownish, hardly paler at base; hind tibiae on the whole yellowish, slightly paler at base and next to this pale area faintly infuscated; hind tarsi obscurely yellowish. Palpi whitish-yellow. Fore-wing faintly tinted, the stigma pale on about basal quarter.

Head somewhat subquadrate, a little narrower behind the eyes than across them. Face with transverse, broken striation. Frons with weak striation, obliterated along the middle line, and towards the eye-margin replaced by a small patch of feeble scaly-reticulation. Vertex entirely smooth. Base of the ocellar triangle a little longer than its sides. Flagellum missing but scape and pedicel of simple form.

Thorax: Pronotal keel well separated from the posterior margin of the pronotum but feeble; lateral area moderately well defined. Mesonotum sloping somewhat gradually to the pronotum, shining, its lobes on the whole finely sculptured; their sculpture consists of fine scaly-reticulation in which, on middle lobe, there is a slight transverse tendency; posterior ridges rather sharply emphasised, but irregular; the branches they give off are feeble and inconspicuous and hardly extend beyond the confines of the notaulices; hairs of the mesonotum long and very sparse. Scutellum almost flat, and almost smooth, anteriorly with two oblique foveae separated by a single ridge. Propodeum: basal carina long, about $1\frac{1}{2}$ times ~~as~~ long as its forks; these rather feebly defined; dorsal areas longer than wide, poorly defined posteriorly and with fine ground sculpture on about anterior half; area petiolaris sharply emphasised, about as long as wide, its bounding carinae rather strongly raised; no trace of posterior protuberances. Disc of the mesopleura highly polished; furrow made up of a number, about 5, of smooth foveae, the middle one by far the longest. Legs: hind coxa somewhat elongate, roundly angled beneath at base but with no trace of a projection here; hind trochanters rather long (fig. 24), together fully three-quarters the length of the hind coxa; hairs of the upper surface of the hind tibia about one and one-third times the middle width of the tibia; lobe with 2 inconspicuous spines; hind tarsus 1 a little more than twice 2, 9 : 4; 3 a trifle shorter than 5, 8 : 9. Fore-wing (fig. 104).

Abdomen: Petiole long, narrow (fig. 21), about 2½ times as long as the propodeum, not noticeably constricted in apical half, wider at extreme apex than across the rather prominent spiracles; a few rather fine ridges present along its entire length; but in the region of the spiracles they tend to break up into vague more or less transverse rugosities; tergite (2 + 3) longer than apically wide. Ovipositor sheaths a trifle longer than the whole body.

Length: 4·5 mm. without ovipositor; ovipositor 5 mm.

INDIA: Dehra Dun, Nakrouda, 30.iv.1934, 1 ♀, bred from rotten wood, (*Sher Bahadur*).

Type in British Museum (Natural History).

This is another distinctive-looking species. As mentioned in the discussion of *hebrus* sp. n., it superficially resembles that species; but the resemblance is, I think, more apparent than real; apart from the differences in the form of the basal segment of the hind tarsus and in the proportions of the lengths of the segments of this tarsus, the petiole is different in form and the surface of the mesopleura of different appearance. There are, of course, many other, smaller differences which are probably only of specific importance. The pale petiole in combination with the pale propodeum is rather unusual.

Spathius carinus sp. n.

♀. A pale yellowish-brown species to the naked eye. Head and thorax pale yellowish-brown; a slight reddish flush along anterior and antero-ventral margin of the pronotum; petiole slightly darker than the thorax; gaster pale brown but darker than thorax, and with three indistinct yellowish spots along each side; the first pair of these are near the apex of tergite (2 + 3); ventral surface of gaster almost entirely yellowish. Antennae pale like the head on about basal third; thence becoming dark brown. Palpi whitish-yellow. Front and middle coxae almost whitish-yellow; hind pair more yellowish, honey-yellow; hind femora honey-yellow with the merest trace of infuscation on outer side; hind tibiae predominantly honey-yellow, but there is a paler post-basal band and the extreme base is somewhat darkened; hind tarsi yellowish but deeper in tint than their tibiae (on distal side of the pale area the surface is very faintly darkened). Wings slightly smoky; stigma of the fore-wing hardly pale at base.

Head somewhat subquadrate, only a little narrower behind the eyes than across them (fig. 20). Face very shining, smooth-looking, with only a trace of transverse striation and this mixed with rather large obsolescent punctures. Frons with strong transverse striation. Vertex completely smooth. Base of the ocellar triangle a little longer than its sides. Antennae with 48 segments, thin, longer than body; flagellum 1 as long as scape plus pedicel; hairs of at least the four basal segments of the flagellum closely recumbent, dark, shorter than the width of the segments.

Thorax: Pronotal keel widely separated from the posterior margin of the pronotum; lateral area clearly delimited. Mesonotum sloping rather gradually to the pronotum (fig. 19), giving the impression of being rather finely, transversely striated all over; the striations of the middle lobe are fine, rather uneven and superimposed on a very feeble ground sculpture which is visible more especially on either side of the middle line; lateral lobes with similar striation which leaves free along the middle an area, blurred in outline, of scaly-reticulation; posterior ridges long, somewhat wrinkled, and more or less parallel; hairs virtually absent. Scutellum shining, almost flat, with feeble scaly-reticulation; its anterior depression divided by a single ridge into two foveae with one or two feeble costae in each of them. Propodeum: basal carina a little longer than its forks; dorsal areas longer than wide, very shining and almost smooth; no trace of posterior protuberances; area petiolaris very sharply emphasised, the ridges bounding it anteriorly and laterally strongly raised. Mesopleural disc very shining, but not quite smooth; furrow hardly costate, except for a strong costa just posterior to middle. Legs (fig. 71): hind coxa elongate, merely rounded beneath at base; hind trochanters shorter than in *daedalus* sp. n.; hind femur somewhat thick; hind tibia somewhat widened to apex; its hairs only semi-erect and only a trifle longer than the middle width of the tibia; lobe with 5 spines; fringe 2–3; hind tarsus 1 twice 2; 3 two-thirds of 5. Recurrens of the fore-wing received into the 2nd cubital cell at a distance from the 1st intercubitus equal to nearly half its own length; nervus parallelus virtually interstitial.

Abdomen: Petiole a little more than twice the length of the propodeum, about 57 : 25, its spiracles not in the least prominent, except for the apical dilatation, of more or less equal width throughout; its surface apical to the spiracles with obsolescent rugosities which towards apex merge into feeble longitudinal wrinkles; gaster narrowly ovate. Ovipositor sheaths as long as thorax plus abdomen.

Length: 5 mm. without ovipositor.

PAPUA: Kokoda, 1200 ft., viii.1933, 1 ♀ (*L. E. Cheesman*).

Type in British Museum (Natural History).

This species is certainly closely related to *daedalus* and probably forms with it part of a distinct species-group. Colour alone will readily separate them, but they differ also in many other details, chief among which are the sculpture of the mesonotum and of the mesopleura and the details of the hind legs.

The group would be characterised by the smooth vertex, free pronotal ridge, ovate hind coxa with no basal projection, long propodeum with its long basal carina, sharply emphasised area petiolaris, almost interstitial nervus parallelus, long, narrow petiole, narrowly ovate gaster and long ovipositor.

Spathius psammenitus sp. n.

♀. Pale brown; the thorax with a reddish tint; gaster yellowish-brown in the type and the female from Los Baños with an extremely faint indication of darker transverse bands; in the 2nd female from Butuan, the gaster is markedly yellowish but faint bands can be made out. Antennae with no yellow segments at apex. Hind coxae pale reddish but yellowish apically in the two females from Butuan; entirely yellow in the female from Los Baños; hind femora faintly yellowish at extreme base in the two females from Butuan, sharply yellowish on about basal $\frac{1}{3}$ in the female from Los Baños; hind tibiae more or less honey-brown but paler on about basal $\frac{1}{4}$. Stigma of the fore-wing yellowish at base.

Head distinctly narrower behind the eyes than across them (fig. 26). Face shining and with rather strong, smooth transverse striation. Frons with fine transverse striation which is rather widely spaced, but interrupted along the middle line. Vertex on anterior half with rather even, moderately strong, transverse striation which is interrupted along the middle line; posterior, declivous part of the vertex completely smooth. Base of the ocellar triangle very distinctly longer than its sides. Antenna with 36 segments (1 ♀, the type); hairs of the flagellum bristling, fully as long as the width of the segments; flagellum 1 to scape plus pedicel as 4 : 3.

Thorax: Pronotal keel in the middle completely fused with the posterior margin of the pronotum; lateral area moderately well defined. Mesonotum sloping rather gradually to the pronotum (fig. 46); middle lobe with a fine but slightly roughened ground sculpture over most of its surface but with a few strong rugae at sides; lateral lobes with coarse transverse rugae which leave free a narrow longitudinal zone of fine surface sculpture; posterior carinae clearly defined, short, subparallel. Scutellum flattened and with a trace of feeble scaly-reticulation, and with a blackened lateral margin. Propodeum: basal carina so short as to be almost wanting; areola sharply defined, separated from the area petiolaris by a sharp ridge; dorsal areas very shining, with some obsolescent rugosity at sides and posteriorly. Disc of the mesopleura almost everywhere smooth and shining. Hind coxa with a sharp, almost dentiform projection; hind femur more or less evenly narrowed from apex to base (fig. 70); hairs of the upper surface of the hind tibia about twice its middle width; lobe with 2, not easily seen, spines; hind tarsus 1 very slightly more than twice 2. Recurrens received into the 2nd cubital cell at a distance from the 1st intercubitus equal to about $\frac{1}{4}$ its own length.

Abdomen: Petiole about $1\frac{2}{3}$ as long as the propodeum, covered with strong but somewhat confluent longitudinal ridges. Ovipositor sheaths about twice as long as the gaster and about as long as whole abdomen plus propodeum.

Length: 4·5 mm. without ovipositor.

PHILIPPINES: Mindanao, Butuan, 2 ♀♀, one the type (*Baker*); Los Baños, 1 ♀ (*Baker*).

Type in U.S. National Museum.

I also refer to this species a single female from Luzon, Mt. Makiling, which, in addition to being larger than the type series, differs from it slightly in colour and sculpture:—general colour darker, more or less chestnut brown but the hind coxae, hind trochanters (except the articulation between the trochanters and femora, which is brown) and basal $\frac{2}{5}$ of the hind femora evenly yellowish; hind tibiae evenly honey-yellow. Striation of the frons and of the vertex stronger; that on the vertex interrupted along the middle line.

I do not think this insect is sufficiently sharply characterised to deserve even a varietal name.

Spathius psammenitus var. **levis** var. n.

Differs from the nominotypical form as follows:—

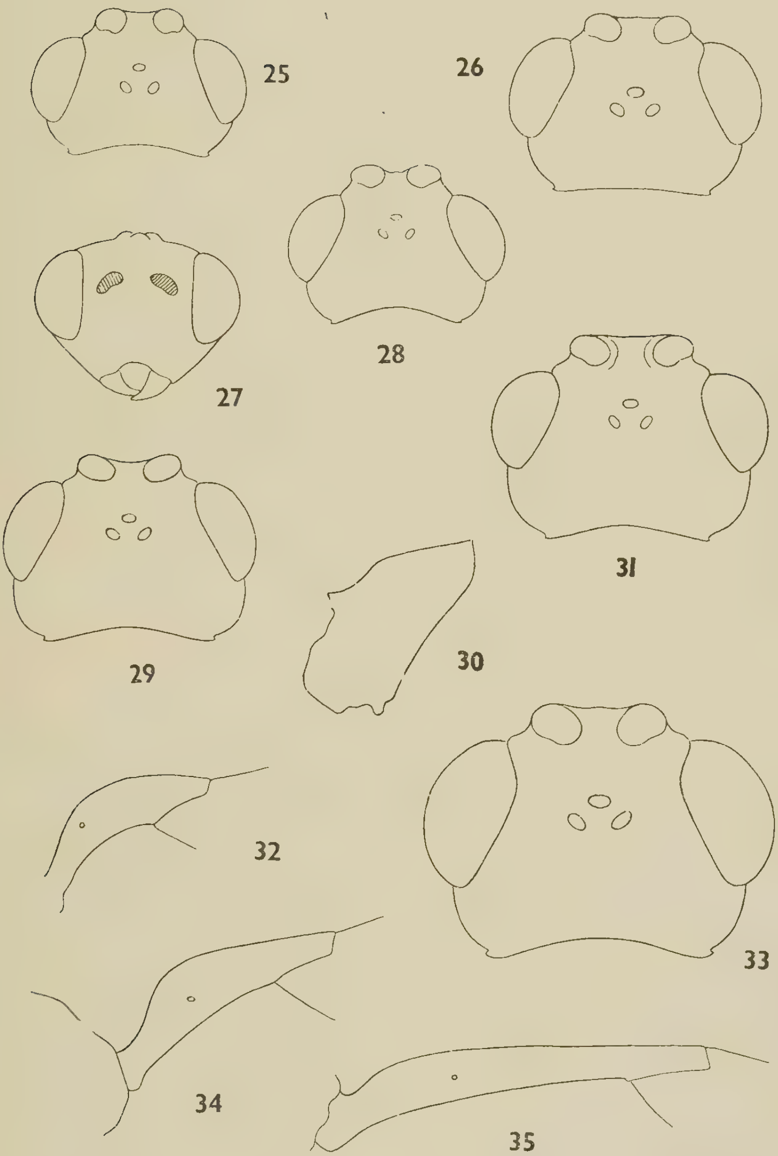
♀. Propodeum and petiole inclining towards blackish in the type but hardly darker than the rest of the thorax in the second female. Head very slightly less narrowed behind the eyes than in typical *psammenitus*. Vertex completely smooth.

PHILIPPINES: I. of Basilan, 2 ♀♀, one the type (*Baker*).

Type in U.S. National Museum.

It is probable that more material might show this variety to be a well-defined geographical form of *psammenitus*.

It should be emphasised, I think, that the species that make up the *psammenitus* complex are very closely related and not easy to separate on anatomical characters. Having had only a few individuals for study, I have often been in doubt as to what kind of name I should give them. Are we dealing here with a number of rather sharply defined geographical races, which might be linked together by transitional forms if collecting had covered a much larger region, or with species in the sense that the museum systematist uses



FIGS. 25–35.—25. *Spathius bion* sp. n., head, dorsal, ♀; 26. *S. psammenitus* sp. n., head, dorsal, ♀; 27. *S. bion*, head, from in front, ♀; 28. *S. eridamus* sp. n., head, dorsal, ♀; 29. *S. polydectes* sp. n., head, dorsal, ♀; 30. *S. gades* sp. n., propodeum, not quite lateral; 31. *S. proxenus* sp. n., head, dorsal, ♀; 32. *S. bion*, petiole, lateral, ♀; 33. *S. periander* sp. n., head, dorsal, ♀; 34. *S. isocrates* sp. n., petiole, lateral; 35. *S. erymanthus* sp. n., petiole, lateral.

that term? That point can be settled only by investigation carried out on a much broader foundation than that on which I now build.

Spathius polydectes sp. n.

This species is very like *psammenitus* and differs from it as follows :—

♀. Body on the whole slightly paler in colour; hind coxae red-brown; hind femora rather sharply yellow on about basal ⅓, otherwise reddish-brown; hind tibiae yellow on about basal ⅔ or ⅓, otherwise reddish-brown.

Head much less narrowed behind the eyes (fig. 29). Face less shining, its transverse striation more wavy, sub-reticulate. Striation of the vertex stronger, more wavy and irregular. Hairs of the flagellum slightly less long.

Scutellum with hardly a trace of scaly-reticulation but with a few transverse rugae posteriorly. Dorsal areas of the propodeum with more shining rugae. Mesopleura with somewhat ill-defined sculpture everywhere; this consists of upward prolongations of the irregular ridges crossing the furrow, and backward prolongations of the irregular ridges within the subalar impression; all these ridges converge on to a smooth spot just posterior to middle. Hind femur less gradually narrowed to base (fig. 69); hind tibia stouter and distinctly swollen basally, the hairs of its upper surface shorter; lobe with 5 spines. Point of emission of the radiella as in *periander* sp. n. (cf. fig. 36).

Petiole without such well-marked ridges as in *psammenitus*, the sculpture over most of the middle part inclining towards obsolescent sub-reticulation.

PHILIPPINES: Luzon, Mt. Makiling, 1 ♀, the type (*Baker*). Los Baños, 1 ♀ (*Baker*). Malinao, Tayabas, 1 ♀ (*Baker*).
Type in U.S. National Museum.

Spathius poliorcetes sp. n.

This is another species with the apical lobe of the hind tibia, as in *polydectes*, obviously spinose. It may be compared with *psammenitus* as follows :—

♀. Altogether darker in colour; the mesonotum obscure purplish-brown to the naked eye, the rest of the thorax appearing still darker; head and gaster deep chestnut-red. Hind coxae reddish-brown, deeper in tint beneath at base; hind femora yellowish on about basal ⅖; hind tibiae more or less honey-brown but paler on basal ⅓ and with a faint infuscation at middle above. Scape and pedicel straw yellow; basal segments of the flagellum almost as pale as these.

Head of the same shape as that of *psammenitus* (cf. fig. 26). Face less shining, the striation close, more wavy and in part sub-reticulate. Vertex with less sculpture, the striation reduced to a small patch behind, and a little to the side of, each ocellus. Antenna broken.

Pronotal keel widely contiguous with the posterior margin of the pronotum but not actually fused with it (it is almost certain that individuals would occur in which fusion was complete). Middle lobe of the mesonotum with more raised sculpture, the ground sculpture being reduced to a narrow band on each side of a medial line of raised rugosities. Basal carina of the propodeum a little longer; dorsal areas less shining, at base with dull surface sculpture, elsewhere with transverse striate-reticulation. Basal projection of the hind coxa more strongly developed; hind femur less evenly narrowed to base; hind tibia less slender, clearly a little swollen in basal ⅖; apical lobe with 5 well-developed spines.

Length: 4–5 mm. without ovipositor.

MALAYA: Singapore, 1 ♀, the type (*Baker*).
Type in U.S. National Museum.

I also refer to this species a single female from the Island of Basilan which is paler in colour and has the hind femora yellow on hardly as much as basal $\frac{1}{5}$.

Although I have compared this species with *psammenitus*, it has, I think, closer affinity with *polydectes* on account of the shape of the hind femur and the presence of several spines on the apical lobe of the hind tibia. It differs chiefly from *polydectes* in the shape of the head as seen from above, the amount of sculpture on the vertex and the smooth disc of the mesopleura; it is also a more sombrely coloured insect.

Spathius periander sp. n.

Here is a species bearing a very close relationship to *poliorcetes* and differing from *polydectes* by the same characters which separate *poliorcetes* from *polydectes*. As these two species have been compared with *psammenitus*, I now compare *periander* with this latter species.

♀. Darker in colour; head, petiole and gaster chestnut-red; thorax with the usual purplish tint. Hind coxae, femora and tibiae unicolorous, chestnut-red; tibiae and femora of the other two pairs of legs likewise unicolorous but paler in tint than the hind pair.

Head similar (fig. 33). Face less shining, rather coarsely transversely striate-reticulate. Frons with some coarse transverse striation, more or less interrupted along the middle line but ending much before the eye-margin. Vertex with only a patch of weak obsolescent striation behind, and a little to the side of, each posterior ocellus; in the smallest of the three females, the vertex is almost without this obsolescent striation. Antenna broken but with at least 39 segments.

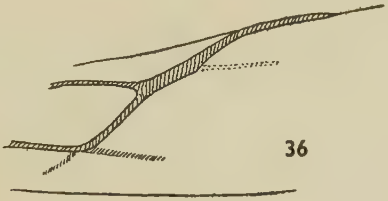


Fig. 36.—*Spathius periander* sp. n., part of hind-wing, ♀.

Pronotal keel contiguous with, but not fused with, the posterior margin of the pronotum. Middle lobe of the mesonotum very slightly more strongly sculptured and with raised rugulosities along the middle line. Dorsal areas of the propodeum showing a trace of ground sculpture at base in the two larger females. Hairs of the upper surface of the hind tibia about $1\frac{1}{2}$ times as long as its middle width; apical lobe with 5 stout spines. Radiella of the hind-wing arising from a point on the subcostella considerably more distal to the apex of the mediellan cell (fig. 36). Ovipositor sheaths considerably longer, almost as long as abdomen plus thorax.

Length: 5–5·7 mm. without ovipositor.

Malaya: Singapore, 1 ♀ (*Baker*). Borneo: Sandakan, 2 ♀♀, one the type (*Baker*).

Type in U.S. National Museum.

This species differs from *poliorcetes* in the colour of the legs, which is actually its most striking feature, in having the legs rather more slender (they are more or less intermediate in form between those of *psammenitus* and *poliorcetes*), and in having the ovipositor a good deal longer. The point of emission of the radiella of the hind-wing is also a little different.

Spathius athesis sp. n.

♀. Differs at once from *psammenitus, poliorcetes, polydectes* and *periander* in having the ovipositor as long as the whole body. The hind femora are yellowish in about basal ¼ to basal ⅓; the hind coxae are reddish-yellow to pale reddish.

Vertex quite smooth.

Lateral lobes of the mesonotum, more especially in the 2 ♀♀ from Zamboanga, with a larger surface of ground sculpture than in the above mentioned species; the area occupied by this fine sculpture is blurred in outline and decidedly not linear. Lobe of the hind tibia with 5 spines.

Length: 4·5–5·8 mm. without ovipositor.

PHILIPPINES: Mindanao, Zamboanga, 2 ♀♀, one the type (*Baker*). I. of Basilan, 1 ♀ (*Baker*).

Type in U.S. National Museum.

In the smaller female from Zamboanga the gaster is yellowish above and below, except for a large brownish patch on tergite (2 + 3) and an ill-defined brownish band on the two following tergites.

Spathius leptothecus Cameron.

Spathius leptothecus Cam., 1908, *Dtsch. ent. Z.* **1908**: 690.

♀. Head brown with the vertex honey-yellow; thorax dark brown with dull reddish suffusion, except on propodeum which is nearly black; petiole nearly black; gaster dark chestnut-brown, slightly paler at extreme base of tergite (2 + 3) and beneath. Antennae broken but scape and pedicel brownish. Palpi whitish-yellow. Front and middle coxae honey-yellow, the hind pair brown; hind femora brown, becoming slightly paler at extreme base; hind tibia and hind tarsus brown throughout. Wings evenly brownish; stigma yellowish on about basal quarter.

Head seen from above approaching a subcubical condition, only a little narrower behind the eyes than across them and not much narrowed towards the occipital margin, like that of *psammenitus* (cf. fig. 26). Face with a smooth blister-like swelling above the clypeus and above this swelling with an elongate elevation; elsewhere with rather strong, shining, somewhat confluent, transverse striation which towards the cheeks breaks up to form mere rugose-reticulation. Frons with strong, very wrinkly striation all over. Vertex more or less smooth, with only the merest trace of transverse striation, and then more especially within the space between ocelli and eye. Ocelli arranged in a triangle the base of which is considerably longer than its sides.

Thorax: Pronotal keel fused with the posterior margin of the pronotum; lateral area well defined, smoothly transversely ribbed. Mesonotum falling almost perpendicularly to the pronotum, its hairs very sparse, outstanding; lobes with much raised rugosity; on the lateral lobes only a narrow, linear area of fine ground sculpture is left free; the middle lobe is covered with short irregular rugosities all over, but on each side of the middle line there are traces of fine ground sculpture; the zone occupied by this sculpture is completely blurred in outline; posterior ridges well defined. Scutellum almost flat, and practically smooth, its anterior depression with 3–4 longitudinal costae. Propodeum: basal carina about ⅖ as long as its forks; areola confluent with the area petiolaris; dorsal areas shining, with a few obsolescent transverse rugae; weak posterior protuberances present. Disc of the mesopleura smooth, highly polished; furrow foveate. Legs: hind coxa with a sharp dentiform projection; hind femur evenly and strongly tapering from apex to base (fig. 88); hind tibia rather slender, the hairs of its upper surface long, erect, fully 2½ times as long as the middle width of the tibia; apical lobe with 2 spines; hind tarsus 1 a trifle more than twice 2, 35 : 16; a little more than ¾ of 5. Wings: recurrens received into the 2nd cubital cell at a distance from the 1st intercubitus equal to nearly one-half its own length; nervus parallelus not interstitial.

Abdomen: Petiole twice as long as the propodeum, with longitudinal ridges which on posterior half break up into vague striate-reticulation. Ovipositor sheaths about as long as thorax plus abdomen.

Length: about 5·5 mm. without ovipositor.

BORNEO: Kuching, i.1907, J. Hewett (*Cameron Coll.*), unique type female in British Museum (Natural History).

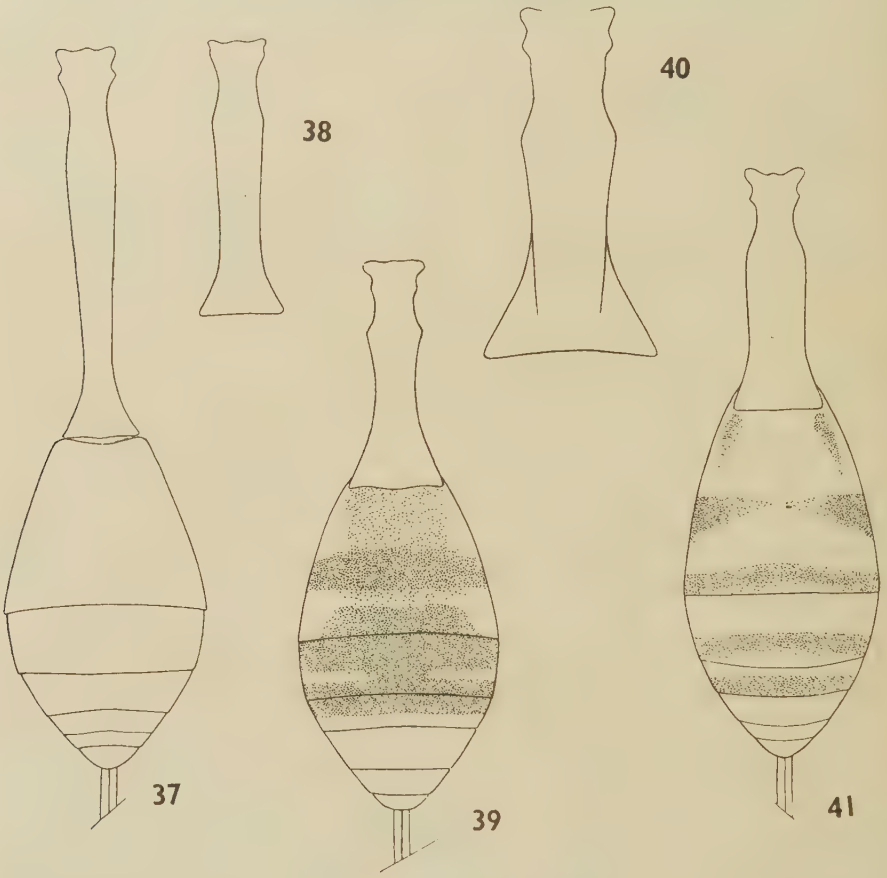
On account of the shape of the hind femur in combination with facies, details of sculpture, I think this species is fairly closely related to *psammenitus* sp. n.; it differs at once from *psammenitus* in having the areola of the propodeum confluent with the area petiolaris and the recurrens of the fore-wing received into the 2nd cubital cell at a greater distance from the 1st transverse cubitus.

Spathius proxenus sp. n.

♀. An unusually pallid species and having a pale greenish-yellow tint to the naked eye. Head whitish-yellow, almost ivory-white on lower parts; a brown patch behind each eye; each of these patches is continued on to the occiput to as far as the occipital foramen; upper surface of the thorax pale tawny yellow; the lateral oblique depression of the pronotum, the mesopleural furrow and the lower part of the metapleura deep red-brown; the sides and lower surface of the thorax otherwise much the same colour as the upper surface but more reddish in tint; petiole reddish-yellow but suffused with darker colouring along sides and across its dorsal surface just beyond middle; gaster pale tawny yellow with two brown spots at side of tergite (2 + 3); these spots spread on to the epipleura of the segment; epipleura of tergites 4 and 5 each with a brown spot. Flagellum pale yellow towards base. Legs entirely pale whitish-yellow except that the hind femora have a brown patch on each side towards apex. Stigma of the fore-wing yellowish on about basal $\frac{1}{3}$ and at extreme apex.

Head somewhat quadrate in a dorsal view but clearly narrower behind the eyes than across them (fig. 31). Face with somewhat confluent transverse striation. Frons and vertex with strong, smooth regular striation; to the sides of the ocelli, this striation is broken up to form a patch of wrinkly rugosity. Longer axis of the eye to malar space as 17 : 12. Ocelli almost in an equilateral triangle. Antenna broken; flagellum 1 as long as scape plus pedicel; hairs of at least the 4 basal segments of the flagellum pale, not longer than the width of the segments.

Thorax: Pronotal keel somewhat narrowly fused in the middle with the posterior margin of the pronotum; lateral area feebly defined. Mesonotum falling abruptly to the pronotum, but not quite vertically; middle lobe with coarse, transverse rugosities which leave free only a narrow band of fine ground sculpture on each side of the middle line; lateral lobes with similar coarse sculpture except for a parallel-sided slightly elevated band of fine ground sculpture; posterior carinae irregular but clearly emphasised; hairs of the mesonotum sparse, semi-erect. Scutellum flat, shining and with traces of obsolescent rugosity; its anterior depression unusually large in area, being almost as long as the shield itself. Propodeum: basal carina very short, much shorter than its forks; ridge separating the areola from the area petiolaris hardly more emphasised than the other transverse ridges in these two areas; dorsal areas with a little shining scaly-reticulation at extreme base but elsewhere with strong rugose-reticulation; weak posterior protuberances present. Mesopleura everywhere with deep sulcation which converges regularly towards the posterior fovea. Legs: hind coxa with a sharp basal projection; hind tibia somewhat thick, slightly swollen at base, the hairs of its upper surface about one and one-third times as long as its middle width; apical lobe with two inconspicuous spines; hind tarsus 1 twice as long as 2; 3 about three-quarters of 5. Recurrens of the fore-wing received into the 2nd cubital cell at a distance from the 1st transverse cubitus equal to about $\frac{1}{3}$ its own length; radius leaving stigma very slightly beyond middle.



FIGS. 37–41.—37. *Spathius dolopes* sp. n., abdomen, dorsal, ♀; 38. *S. cheops* sp. n., petiole, ♀; 39. *S. sabronensis* sp. n., abdomen, dorsal, ♀; 40. *S. proxenus* sp. n., petiole, ♀; 41. *S. ares* sp. n., abdomen, dorsal, ♀.

Abdomen: Petiole rather short and thick (fig. 40); its dorsal surface covered with confluent striation which straightens out within the preapical constriction. Ovipositor sheaths a trifle longer than the gaster.

Length: 4·75 mm. without ovipositor.

PHILIPPINES: Biliran Is., 1 ♀ (*Baker*).
Type in U.S. National Museum.

Spathius betremi sp. n.

This species seems to be naturally and closely allied to *proxenus* sp. n., having like that insect the same pallid appearance to the naked eye. It may be compared with *proxenus* as follows:—

♀. *Head* more yellowish; behind the eyes there is an excessively faint brownish cloud, hardly noticeable; occiput on each side with a large brownish cloud (much larger than the corresponding dark area in *proxenus*); the whole of the mesosternum as far as, and including, the mesopleural furrow red-brown; the sides of the pronotum are faintly darkened within the oblique impression; petiole almost black but a little reddened on its basal curved surface; gaster more or less entirely yellow, very pale and in sharp contrast with the blackened apex of the petiole; medially, *i.e.*, basal part of tergite 4, there is a faint brownish patch; there is a still fainter (hardly visible) spot on tergite 5; tergite 7 shows a faint transverse brown band; the epipleura of tergite (2 + 3) shows an elongate brown area, constricted in the middle. Brown patches on each side of the hind femora much larger in extent than in *proxenus*, the colour separating them above only a little paler than that of the patches themselves.

Head less narrow behind the eyes. Eyes less bulging, larger, their longer axis about equal to the malar space. Striation of frons and vertex finer, closer, about 16 ridges being present on vertex while in *proxenus* there are about 10. Ocellar triangle much less nearly equilateral.

Mesonotum with much less shining raised rugosity; the middle lobe is dull and in far greater part finely rugulose; the lateral lobes have a large area of fine rugulosity which extends more or less to the lateral margin but on the anterior part of the lobe is replaced by raised rugosity. Scutellum dull, closely, evenly scaly-reticulate; its anterior depression normal, less than half as long as the shield proper. Dorsal areas of the propodeum dull and, over rather more than their basal half, scaly-reticulate; posteriorly with only feeble raised rugosity; no emphasised ridge separating areola from area petiolaris. Disc of the mesopleura with a little feeble raised rugosity in the form of delicate ridges mixed with a scaly-reticulate ground sculpture. Basal projection of the hind coxa less prominent; hind tibia slightly less thick. Recurrens received into the 2nd cubital cell nearer the 1st intercubitus, almost interstitial.

Petiole a little less thick, a little less dilated at apex and its longitudinal carination slightly less confluent. Ovipositor sheaths as long as the gaster.

Length: 4·5 mm. without ovipositor.

JAVA: Buitenzorg, xi.1929, 1 ♀, bred from branch of *Cassia multijuga*.

Type in British Museum (Natural History).

I am not sure about the relationships of these two striking-looking species though it is probable that they are most closely allied to the *psamennitus–isocrates* complex; shape of head, fusion of pronotal carina with posterior margin of pronotum, propodeal structure, unicolorous hind tibiae and short ovipositor suggest that *isocrates* is the nearest ally.

Spathius helle sp. n.

This species seem to be fairly closely related to *proxenus* and *betremi* spp. n. on the one hand and to *ares* sp. n., on the other. Having a short ovipositor it resembles the two former species but its more generalised colour pattern suggests a closer approach to *ares*. I propose to compare it with this last-mentioned species.

♀. Face very slightly embrowned in the middle; in the type, the head shows a very faint brownish cloud behind the eyes; mesonotum without dark patches on lateral lobes, though these are perhaps a trifle more brownish or reddish than the middle lobe in the type; disc of the mesopleura and the mesosternum with a decidedly yellowish tint; gaster bright brownish-red; tergite (2 + 3) faintly yellowish as follows:—narrowly along apical margin, a very ill-defined cloud on each side on basal half; epipleura with a large, rather sharply discrete brownish patch, narrowly connected with the brown colour of the dorsum; the ventral surface of the gaster is bright yellow on basal half. Hind femora with small brownish cloud on each side at apex; no trace of infuscation on hind tibiae.

Face very shining, much more finely sculptured. Frons smoothly and very regularly striate. Vertex almost smooth; very faint traces of striation, widely interrupted along the middle, are present.

Pronotal keel narrowly contiguous with the posterior margin of the pronotum. Mesonotum falling less steeply to the pronotum, its sculpture much finer, the lobes in greater part having a fine broken scaly-reticulation; posterior carinae clearly defined but broken. Basal carina of the propodeum a little shorter than its forks; areola and area petiolaris more or less confluent; dorsal areas more shining, less coarsely sculptured. Disc of the mesopleura smooth and highly polished. Hairs of the upper surface of the hind tibia longer, the longest of them fully twice its middle width; hind tarsus shorter and stouter, segment 1 being exactly twice 2; 3 is $\frac{2}{3}$ of 5 (fig. 81). Recurrens received into the 2nd cubital cell at a distance from the 1st intercubitus equal to nearly half its own length.

Striation of petiole less regular, somewhat confluent. Ovipositor sheaths about as long as the gaster.

PHILIPPINES: Los Baños, 16.iii.1923, 2 ♀♀, one the type (*A. Rowan*).
Type in U.S. National Museum.
This species differs from *proxenus, betremi* and *ares* spp. n. at once in the sculpture of the head.

Spathius ares sp. n.

♀. Head pale brownish-yellow suffused with darker colouring on the face; sides of the pronotum above and the mesonotum, except for an elongate brownish patch on each lateral lobe, same colour as the head; rest of the thorax brownish-red, suffused with darker colouring; the disc of the mesopleura is usually rather brightly reddish, but the mesopleural furrow is usually blackened; petiole blackened but reddish towards apex; gaster bright yellowish-red with darker bands (fig. 41); on tergite (2 + 3) the infuscation takes the form of a basal streak on each side and a triangular spot on each side just beyond middle; these markings on tergite (2 + 3) may be increased in size and become confluent; ventral surface of the gaster brown at sides but pale along the middle. Scape, pedicel and 1st flagellar segment pale yellowish, the flagellum thence gradually darkened to apex. Palpi pale yellow. All the coxae pale yellow; hind femora pale yellow but embrowned in apical third; hind tibiae almost whitish-yellow but with the faintest trace of infuscation at middle, along upper surface.

Head somewhat subquadrate, but clearly narrower behind the eyes than across them, similar to that of *proxenus* (cf. fig. 31). Face rugose-reticulate with weak transverse elements. Frons with broken transverse striation which reaches the eye-margin. Vertex everywhere with close, wrinkly rugosity in which only a feeble transverse element is visible. Ocelli nearly in an equilateral triangle. Antenna with 31 segments (1 small ♀); 35–36 (3 large ♀♀); flagellum 1 only a trifle longer than scape plus pedicel, 13 : 12; hairs of at least the four basal segments of the flagellum pale, not longer than the width of the segments.

Thorax: Pronotal ridge fused with the posterior margin of the pronotum. Mesonotum falling almost perpendicularly to the pronotum, covered with coarse reticulate rugosities which leave free a narrow band of fine ground sculpture on each side of the middle line of the middle lobe and a band of fine ground sculpture along the middle of each lateral lobe; this band on the lateral lobes is fairly sharply discrete and more or less coincides with the brown area in extent; posterior ridges in large individuals clearly emphasised but in small individuals very weak. Scutellum dull, more or less flat, finely sculptured all over. Propodeum: basal carina usually represented by two short, closely approximated carinae each of which is an anterior prolongation of the normal propodeal forks which, in the case of the individuals concerned, have not met anteriorly to form the basal carina; in two of the smallest females the normal single basal carina is present but it is very short; dorsal areas irregularly reticulate, virtually all over; areola separated from the area petiolaris by a rather weak ridge; hardly a trace of posterior protuberances. Disc of the mesopleura shining but not quite smooth. Legs: hind coxa with a weak basal projection; hind femur normal; hind tibia rather slender, the hairs of its upper surface only a trifle longer than the middle width of the tibia; apical lobe with 3 pale, inconspicuous spines; hind tarsus 1 a little more than twice 2, 12 : 5; 3 three-quarters of 5; fringe 2–3. Recurrens almost interstitial.

Abdomen: Petiole about 1½ times as long as the propodeum, longitudinally, and in large females fairly regularly, striated; extreme base of the gaster with a faint trace of striation medially. Ovipositor sheaths about as long as the whole abdomen.

Length: 3·5–4·5 mm. without ovipositor.

♂. In most details like the female but differing as follows:—brown patch on the lateral lobes of the mesonotum hardly or only faintly indicated; basal carina of the propodeum represented by a single ridge which in two males is very short, in the 3rd is nearly as long as its forks. No trace of infuscation on the hind tibia. Tergite (2 + 3) brown on basal two-thirds, with a narrow lateral and broad apical, yellow margin; tergite 4 with a broad yellow band; apex of gaster yellow; tergite (2 + 3) with somewhat obsolescent, longitudinal striation reaching to nearly the apex of the brown area; there is also some obsolescent sculpture on the apical part of the segment.

Length: 3·5 mm.

INDIA: Bengal, Apalchand Range, Jalpaiguri, xii.1934, 2 ♀♀, ex *Premna bengalensis*; 15.i.1935, 1 ♂, ex *Premna bengalensis*; 2.iv.1935, 1 ♂, ex *Garuga pinnata*; Bengal, Kalimpong, Samsingh, 1800 ft., 3.iv.1934, 3 ♀♀, one the type (*Balwant Singh*); Bengal, Jalpaiguri, Gazalduba, 22.xi.1933, 1 ♂ (*N. C. Chatterjee*).

Type in British Museum (Natural History).

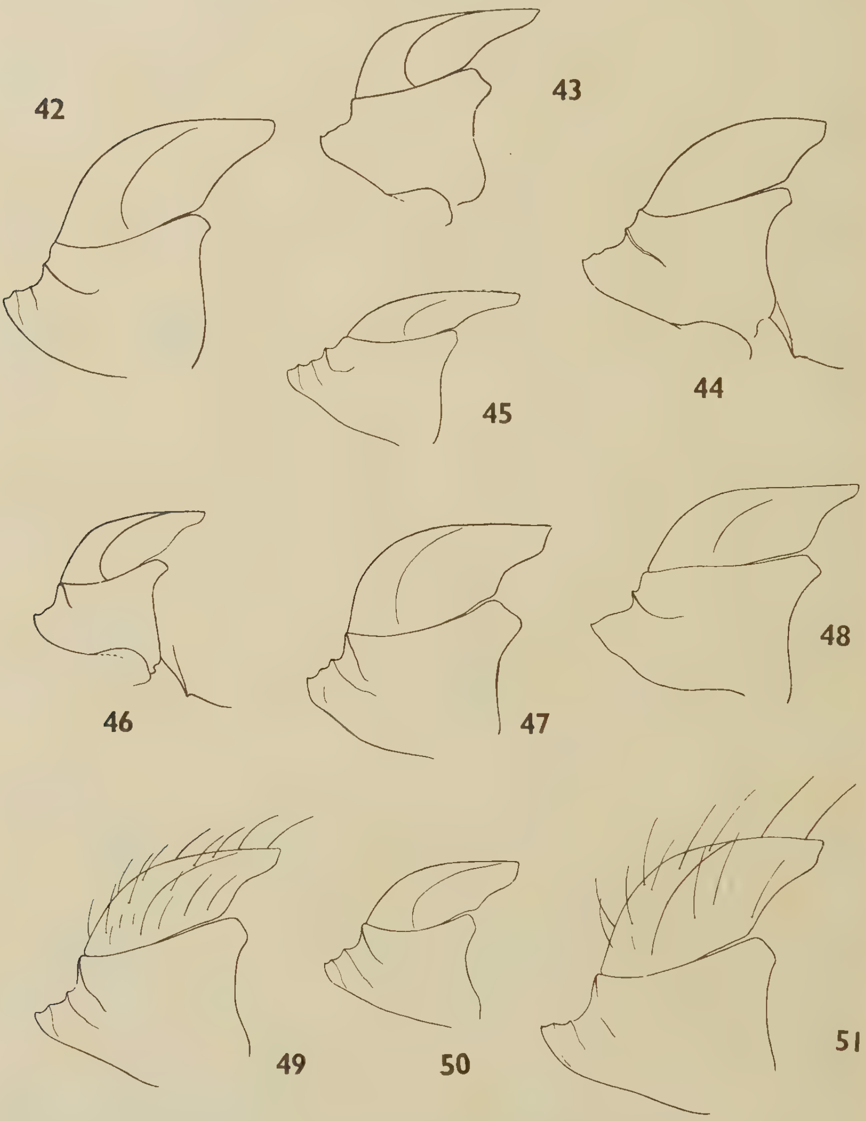
This is another species of rather doubtful affinities. It is probably fairly closely related to *proxenus* though specifically very different from that species. The coarsely rugose vertex, brown patch on the lateral lobes of the mesonotum, pale legs and rather brightly coloured abdomen render it very distinctive.

Spathius asander sp. n.

♀. Reddish-brown with the lower surface of the mesosternum and propodeum darkened. Legs honey-yellow but the hind coxae, except perhaps at apex, and the hind femora, except on about basal ⅓, infuscated; hind tibiae very faintly darkened in the middle.

Head seen from above as in fig. 59. Face with a feeble medial elevation between the base of the clypeus and the antennal insertions; the sculpture on each side of the elevation consists of irregular transverse striation. Frons with very fine, obsolescent striation. Vertex completely smooth. Base of the ocellar triangle a little longer than its sides. Antenna with 34 segments (type); flagellum clothed with bristling hairs which are fully equal to the width of the segments.

Thorax: Pronotal keel virtually fused with the posterior margin of the pronotum in the middle; lateral area moderately well defined, crossed by a few strong ridges. Mesonotum sloping very gradually to the pronotum, its sculpture on the whole fine, the scaly-reticulate ground sculpture predominating; the notaulices are rather deep but their costae encroach only very feebly on to the lateral lobes; posterior carinae short, feebly developed; mesonotal hairs long, sparse, outstanding. Scutellum almost flat, with traces of ground sculpture and with a darkened lateral margin. Basal carina of the propodeum very short, about 4–5 times shorter than its forks; areola completely separated from the area petiolaris by a strong ridge; no prominent posterior protuberances; dorsal areas at least on anterior half with a somewhat dull scaly-reticulation. Disc of the mesopleura very shining, more or less smooth; there are faint traces of surface sculpture. Hind coxa with a dentiform projection at base; hind femur short, rather stout (fig. 72); lobe of the hind tibia with 3–4 spines; hairs of the upper surface of the hind tibia about twice as long as its middle width; hind tarsus 1 twice 2; 3 is ⅔ of 5. Recurrens received into the 2nd cubital cell at a distance from the 1st transverse cubitus equal to ¼ its own length; nervus parallelus far from interstitial.



Figs. 42–51.—Anterior part of thorax of *Spathius*:—42. *Spathius gades* sp. n.; 43. *S. artabazus* sp. n.; 44. *S. prodicus* sp. n.; 45. *S. eridamus* sp. n.; 46. *S. psammenitus* sp. n.; 47. *S. isocrates* sp. n.; 48. *S. dolopes* sp. n.; 49. *S. neleus* sp. n.; 50. *S. asclepiades* sp. n.; 51. *S. moscus* sp. n.

Abdomen: Petiole about 1½ times as long as the propodeum, longitudinally ridged, the ridges fairly even. Ovipositor sheaths twice as long as the gaster.

Length: about 4·5 mm. without ovipositor.

BORNEO: Sandakan, 2 ♀♀, one the type (*Baker*).
Type in U.S. National Museum.

Spathius asclepiades sp. n.

This species seems to be closely related to *asander* from which it differs as follows:—

♀. Head and sometimes the mesonotum with a slight yellowish tint; propodeum, metapleura and petiole blackened in two females, including the type, and with a faint reddish suffusion in the third; gaster rich chestnut brown. Hind coxae entirely yellowish; infuscation of the hind femora reduced to an ill-defined brownish patch on each side.

Head presenting a slightly different appearance as seen from above; this is probably due to very slight dorso-ventral compression and to the eyes being very slightly larger (fig. 58). Face a little less shining, due to the presence of very faint ground sculpture; the striation on each side of the medial elevation is finer. Striation of the frons stronger. Vertex with fine, obsolescent transverse striation. Antenna with 30–31 segments (2 exs.).

Thorax showing very slight dorso-ventral compression by comparison with *asander*. Anterior slope of mesonotum as in fig. 50. In one of the three females (not the type), the ridge separating the areola from the area petiolaris is hardly emphasised, as the areola itself is crossed throughout its length by similar ridges; in the other two females, the ridge is isolated and well defined; prominent posterior protuberances present. Disc of the mesopleura not smooth, having a ground sculpture and a few superimposed longitudinal rugae. Lobe of the hind tibia with 1–2 spines; these are very difficult to see at a magnification of × 60.

Petiole shorter, only about 1¼ times as long as the propodeum and seen from the side, more elbowed at base. Ovipositor sheaths about as long as the gaster.

Length: about 4 mm. without ovipositor.

MALAYA: Singapore, 3 ♀♀, one the type (*Baker*).
Type in U.S. National Museum.

The most obvious difference between this species and *asander* lies in the length of the ovipositor, but the two species are amply distinct on other characters.

Spathius isocrates sp. n.

This is another species related to *asander* and with the ovipositor sheaths as long as in that species. It may be compared with *asander* as follows:—

♀. Head with a decidedly yellowish tint; propodeum and metapleura with a purplish-red tint to the naked eye; petiole reddish; tergites 7 and 8 yellowish so that the gaster has a pronounced yellow tip; the other tergites sometimes have a yellowish apical margin. Hind coxae only feebly infuscated; in one female hardly so at all.

Frons with rather coarse irregular striation. Vertex finely transversely striated, the striation somewhat obsolescent and tending to be interrupted along the middle line. Antenna with 33–34 segments; hairs of the flagellum very slightly shorter and finer.

Pronotal keel less distinct, the mesonotum falling almost perpendicularly to the pronotum (fig. 47). Scutellum less triangular, its posterior margin almost truncated; shining on about anterior ⅔; dull and scaly-reticulate on about posterior ⅓. Propodeum a trifle shorter, its posterior declivity a little more abrupt; ridge separating the areola from the area petiolaris poorly developed, hardly emphasised. Disc of the mesopleura more or less smooth, highly polished. Lobe of the hind tibia with 2 spines. Recurrens of the fore-wing received into the 2nd cubital cell at a distance from the 1st transverse cubitus equal to nearly ½ its own length.

Petiole a little shorter, in profile much more elbowed at base (fig. 34).

MALAYA: Singapore, 4 ♀♀, one the type (*Baker*).

Type in U.S. National Museum.

This species differs from *asclepiades* in having *inter alia* a longer ovipositor and a more abrupt anterior slope to the mesonotum.

Spathius nearchus sp. n.

♀. Pale reddish-brown with a yellowish tinge; to the naked eye there is no contrast of light and dark areas and the species is quite dark-looking; the head and mesonotum are slightly paler in tint than the other parts of the thorax; the lower part of the face is faintly darkened. Legs honey-yellow to honey-brown; hind coxae and hind femora except the latter on basal ⅓, infuscated; all the tibiae slightly darkened in the middle and pale at base; hind tarsi brownish. Maxillary palpi yellow throughout. Fore-wing more or less uniformly tinted; stigma yellowish on rather more than basal ⅓.

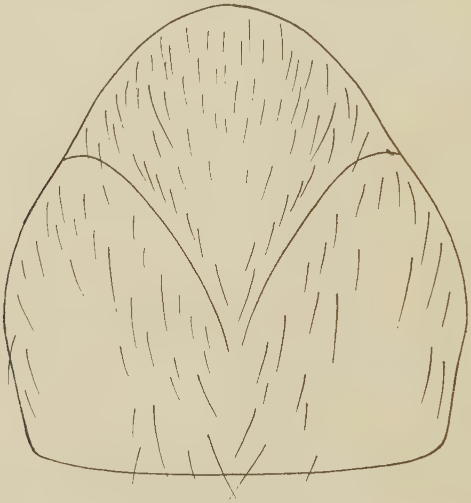


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FIG. 52.—*Spathius nearchus* sp. n., mesonotum.

Head only very slightly narrower behind the eyes than across them, approaching a subcubical condition, like that of *asander* (cf. fig. 59). Face shining, feebly and irregularly striated on each side of the weak medial elevation. Frons completely smooth or with the merest trace of fine striation. Vertex completely smooth and highly polished. Base of the ocellar triangle clearly a little longer than its sides. Antenna broken but with at least 32 segments in the type; 34–36 would be the probable number; hairs of the flagellum bristling, fully as long as the width of the segments; flagellum 1 about 1½ times as long as scape plus pedicel.

Thorax: Pronotal keel medially fused with the posterior margin of the pronotum in two females; in the third very slightly separated from it; lateral area rather poorly defined. Mesonotum rather strongly arched in front, falling almost perpendicularly to the pronotum; its hairs numerous, semi-erect, very uneven in length (fig. 52); lobes with fine more or less even scaly-reticulation; posterior carinae well defined. Scutellum almost flat and with traces of surface sculpture. Propodeum: basal carina $\frac{1}{3}$ to $\frac{1}{2}$ the length of its forks; dorsal areas sharply defined, longer than wide, shining and with hardly a trace of surface sculpture in one female; but with faint traces of such sculpture in the type, and in the third female dull, scaly-reticulation covering almost the whole surface; ridge separating the areola from the area petiolaris sharply defined; no trace of posterior protuberances. Disc of the mesopleura appearing shining and polished but not absolutely smooth. Legs very slender; hind coxa with a weak dentiform projection; hind femur fairly evenly narrowed to base; apical lobe of the hind tibia with 5 spines; hairs of the upper surface of the hind tibia set at about 60 degrees and about $1\frac{1}{2}$ times as long as its middle width; hind tarsus 1 slightly less than twice 2; 3 virtually as long as 5. Recurrens nearly interstitial; nervus parallelus far from interstitial.

Abdomen: Petiole rather long, about $1\frac{2}{3}$ as long as the propodeum, covered with obsolescent and/or confluent ridges. Ovipositor sheaths about as long as the abdomen plus thorax and nearly four times as long as the gaster.

Length: 3·5–4 mm. without ovipositor.

MALAYA: Singapore, 2 ♀♀, one the type (*Baker*). BORNEO: Sandakan, 1 ♀ (*Baker*).

Type in U.S. National Museum.

I also refer to this species a second female from Sandakan in which the vertex shows the merest trace of transverse striation and the propodeal region is almost black; the base of tergite (2 + 3) shows distinct traces of fine striation covering an area equal in length to about the third segment of the hind tarsus.

Spathius nearchoides sp. n.

This is a form extremely like *nearchus* sp. n., and possibly not distinct from it specifically. As there are small though constant differences it seems better to keep them apart at least provisionally. A comparison follows:—

♀. Larger than *nearchus* (this may be of no significance since I may have described *nearchus* from small specimens). Gaster a little paler and with small, very faint dark blotches along lateral margin of tergites (2 + 3) and 4; the 2 ♀♀ from Lachiwala have the gaster quite markedly yellowish and the lateral blotches in consequence more distinct; also the propodeum is paler than the rest of the thorax. Hind femora pale only at extreme base.

Antenna 37–41-segmented (2 ♀♀); flagellum less long in proportion to scape plus pedicel, about 7 : 6. Base of the ocellar triangle longer.

Sculpture of the mesonotum quite characteristic; fine, obsolescent, very confluent striation spreads, in a slightly forward direction, from the notaulices on to the lateral lobes; along the middle, the lateral lobes show large, shallow, very ill-defined and indistinct punctures. Scutellum decidedly a little convex, smooth or nearly so. Dorsal areas of the propodeum very shining and over most of their medial surface almost smooth; ridge separating the areola from the area petiolaris feebly defined.

Petiole a little shorter. Tergite (2 + 3) with faint traces of striation on each side at base.

Length: 4·5 mm. without ovipositor.

♂. Like the female (the ♂ of *nearchus* is unknown) except for the usual sexual differences and as follows:—

Tergite (2 + 3) with strong, smooth striation reaching almost to apex and divided just beyond middle of segment by a smooth shining line. Length: 4–5 mm.

INDIA: United Provinces, Dehra Dun, Lachiwala Range, 2 ♂♂, 2 ♀♀, one ♀ the type, 10–11.xii.1920; 1 ♂, 18.x.1921, "ex *Vitis latifolia*" (*C. F. C.*

Beeson); Dehra Dun, Nakronda, 1 ♀, bred 10.vi.1936, 2 ♀♀, bred 9.vii.1936 from unknown wood.

Type in British Museum (Natural History).

This species and *nearchus* closely resemble *S. elagabalus* sp. n., differing from it chiefly by having a much longer ovipositor.

Spathius elagabalus sp. n.

Differs from *nearchus* as follows :—

♀. Darker in colour; propodeum, most of mesothorax, and petiole black; in the two larger examples, including the type, the mesonotum is very dull reddish; in the third female it is decidedly reddish-brown; gaster chestnut brown with a faint paler band across the apical margin of tergite (2 + 3). The infuscation of the hind coxae tends to be restricted to lower half; that of the hind femora tends to take the form of a brown patch on each side of the femur in apical half; all the tibiae evenly yellow.

Head decidedly more transverse (fig. 60). Sculpture of the face stronger. Frons with sharp, strong striation. Antenna broken; hairs of the flagellum paler, slightly less outstanding.

Mesonotum slightly less abruptly sloping down to the pronotum; its hairs more numerous (a characteristic feature of this species) and, on the whole, considerably shorter; sculpture of the lobes a little less fine in the two larger examples, the lateral ones showing transverse, ill-defined, obsolescent rugulosities along inner half. Scutellum dull, closely scaly-reticulate all over. Basal carina of the propodeum much shorter, only about $\frac{1}{4}$ the length of its forks; dorsal areas with dull scaly-reticulation over most of anterior half; posterior protuberances present but weak. Disc of the mesopleura nowhere smooth, being weakly shining and covered with an obsolescent surface sculpture mixed with obsolescent ridges which run in a dorso-ventral direction. Hind femur stouter, less evenly narrowed to base; hind tibia stouter and shorter; hind tarsus shorter and stouter but the relative lengths of the segments much the same. Recurrens of the fore-wing received into the 2nd cubital cell at a greater distance from the 1st transverse cubitus.

Petiole a little shorter. Tergite (2 + 3) distinctly striated at base in the type and 2nd large female but hardly so in the smallest female. Ovipositor about twice as long as the gaster.

Length: 4·5–4·8 mm. without ovipositor.

BORNEO: Sandakan, 3 ♀♀, one the type (*Baker*).

Type in U.S. National Museum.

In general facies, this species bears a strong resemblance to the members of the group of *tityrus*, and if the fact that the base of the gaster does show some sculpture is taken into account, the only character which would justify the exclusion of *elagabalus* from that group appears to be the existence of the dentiform projection at the base of the hind coxa.

Altogether this is a more stoutly built species than either *nearchus* or *nearchoides* and it is this very feature which enhances the resemblance to the *tityrus*-group.

Spathius seres sp. n.

Here is another species with thickly pubescent mesonotum. It is more compact in form than *nearchus* and in general facies approaches *elagabalus* more closely. It differs from *nearchus* as follows :—

♀. Much paler in colour, appearing pale yellowish-brown to the naked eye; the mesothorax ventral to the mesopleural furrow, the propodeum and the petiole reddened; the head and mesonotum are markedly yellowish and the face is not at all darkened below; ventral surface of the gaster, more especially towards the base, markedly yellowish; tergite (2 + 3) with a yellowish apical margin. Except that the hind femora are slightly infuscated on apical half (the infuscation forming an ill-defined patch on each side), the legs are pale honey-yellow throughout; the middle femora show the faintest trace of a dark patch on each side; it is highly probable that individuals might occur in which the middle femora and perhaps the front pair also would show an appreciable amount of infuscation. Scape pedicel and basal segments of the flagellum much brighter yellow. Stigma of the fore-wing yellowish on basal ¼.

Head a little more transverse. Sculpture of the face a little stronger. Antenna broken; segments of the flagellum less elongate; flagellum 1 not longer than scape plus pedicel.

Pronotal ridge medially fused with the posterior margin of the pronotum. Mesonotum a trifle more transverse, the sculpture still finer, the notaulices less deeply impressed; mesonotal hairs more numerous, shorter, more even in length; long hairs much less numerous than in either *nearchus* or *elagabalus*. Propodeum shorter, the dorsal areas not longer than wide, their surface somewhat dull, covered almost all over with scaly-reticulation; basal carina a little shorter; posterior protuberances present but weak. Legs less slender; hind femur slightly less evenly narrowed to base; lobe of the hind tibia with 4 spines; hairs of the upper surface of the hind tibia a little shorter in proportion to its middle width; hind tarsus 3 clearly a little shorter than 5 (fig. 85).

Petiole shorter and thicker, more elbowed at base as seen from the side. Ovipositor sheaths much shorter, only about 1⅓ times as long as the gaster.

Malaya: Singapore, 1 ♀ (*Baker*).

Type in U.S. National Museum.

This species differs from *elagabalus*, *inter alia*, in colour, virtually unsculptured disc of mesopleura, different details of propodeal structure and shorter ovipositor.

Spathius artabazus sp. n.

♀. Differs from *nearchus* as follows :—

Paler in colour, the head and the mesonotum markedly yellowish. Except for the hind tarsus, which is brownish, the legs are pale honey-yellow virtually throughout; the hind femora show only the faintest (hardly visible) flush of infuscation on outer side. Wings smoky brown; stigma slightly paler on about basal ¼.

Head more narrowed behind the eyes and more narrowed towards the occipital margin, hence lacking the somewhat subcubical appearance of *nearchus* (fig. 57). Frons with rather strong sharp striation. Antenna broken.

Pronotal keel narrowly fused in the middle with the posterior margin of the pronotum; pronotum in profile presenting a slightly different appearance (fig. 43). Hairs of the mesonotum shorter, more evenly distributed and more numerous; sculpture of the lateral lobes less fine, feeble transverse rugae being present along the outer side and similar rugae encroaching outwards from the notaulices so that the ground sculpture is confined almost to a medial narrow, linear area; owing to the pale colour of the mesonotum the sculpture of the lateral lobes is not easily made out. Basal carina of the propodeum about ¼ as long as its forks; dorsal areas smooth and very shining; posterior protuberances rather well developed. Disc of the mesopleura shining, virtually smooth. Hind tibia with 2 spines to its apical lobe; these are extremely difficult to see; hind tarsus 3 slightly shorter than 5, 5 : 6.

Petiole slightly shorter in proportion to the length of the propodeum. Ovipositor sheaths slightly shorter, about 3½ times as long as the gaster.

Borneo: Sandakan, 1 ♀ (*Baker*).

Type in U.S. National Museum.

This species seems to be largely characterised by the reduction of fine sculpture on the lateral lobes of the mesonotum, smoky wings and pale yellow legs. Just as the shape of the head alone will separate it from *nearchus*, so will the same feature serve to distinguish it from *elagabalus*; but there are several other points of difference between *artabazus* and *elagabalus*, as a comparison of their descriptions will show.

Spathius alcine sp. n.

♀. A fairly stout species, small and very dark to the naked eye. Head brown, paler beneath; thorax more or less black but the propleura reddish and the lower part of the sides of the pronotum suffused with reddish; petiole with a slightly reddish tint; gaster dark reddish-brown, paler along its articulation with the petiole. Palpi pale yellow. Hind coxae and hind femora more or less honey-brown, the latter slightly paler at base; hind tibiae pale brownish but with a semitransparent postbasal band; front and middle coxae more or less honey-yellow.

Head much as in *artabazus* (cf. fig. 57) but a little less narrowed behind the eyes. Face shining, nearly smooth. Frons with only the merest trace of striation. Vertex completely smooth. Base of the ocellar triangle very slightly longer than its sides. Antenna broken but with at least 31 segments; f. 1 as long as scape plus pedicel; hairs of the more basal segments fully $\frac{2}{3}$ their middle width. Eyes large, about 3 times as long as the malar space, 17 : 6.

Thorax: Pronotal keel very feebly developed but apparently widely fused with the posterior margin of the pronotum. Mesonotum falling almost perpendicularly to the pronotum, clothed thickly with semi-recumbent hairs of different lengths; sculpture of lobes almost everywhere fine and even; posterior carinae distinct but a little irregular; hardly any raised rugosity on each side of them. Scutellum slightly convex, shining, almost smooth. Propodeum short; basal carina much shorter than its forks; areola separated from the area petiolaris; dorsal areas shining, nearly smooth, except around edges. Anterior part of the mesopleural furrow deep, smooth, except for minute foveae along the bottom; posterior part shallow, foveate; disc extensively smooth and shining. Legs: hind coxa with a small dentiform projection; hind femur somewhat stout; hairs of the upper surface of the hind tibia semi-erect, rather short, only a little longer than its middle width, 5 : 4; apical lobe with 2 inconspicuous spines; hind tarsus 1 twice 2; 3 nearly as long as 5, 6 : 7. Recurrens almost interstitial; nervus parallelus from middle.

Abdomen: Petiole rather short, $1\frac{1}{2}$ times as long as the propodeum, striate-reticulate but the longitudinal element not conspicuous; gaster short, broad, $1\frac{1}{3}$ times longer than wide; at extreme base with the merest trace of longitudinal striation on each side. Ovipositor sheaths a little longer than gaster plus petiole.

Length: about 3 mm. without ovipositor.

India: United Provinces, Dehra Dun, Jhajra, 1 ♀, bred 14.vii.1928, " ex *Grewia vestita* " (*C. F. C. Beeson*).

Type in British Museum (Natural History).

Related to *seres* and *elagabalus* spp. n., differing from both in having larger eyes, differently coloured hind legs; from *seres*, in particular, it differs in having a black thorax and from *elagabalus* in the absence of sculpture on the disc of the mesopleura.

Spathius lissus sp. n.

This is the sixth species I include in the somewhat heterogeneous group of species in which the mesonotum is comparatively thickly hairy. This form certainly has the mesonotum less hairy than the other species and it differs most readily from all of them in the degree of infuscation of the legs. It may be compared with *nearchus* as follows :—

♀. The mesonotum is not paler than the rest of the thorax and the lower part of the face is not darkened. Scape and pedicel with a reddish tinge; flagellum brown throughout. Front and middle coxae faintly embrowned; all the femora brown throughout; tibiae also brown but becoming transparent yellowish on rather less than basal half. Base of tergite (2 + 3), where it is in contact with the apex of the petiole, narrowly yellowish, the yellow band dilated on each side. The two basal segments of the maxillary palpi, and to a less extent also the 3rd, darkened.

Head a little more transverse. Frons with strong, sharp striation which virtually reaches the eye-margin. Vertex with feeble, somewhat obsolescent striation which is interrupted along the middle and fades out at a considerable distance from the eye-margin. Antenna with 35 segments; hairs of the flagellum decidedly shorter, more recumbent, quite inconspicuous; flagellum 1 not longer than scape plus pedicel.

Pronotal keel fused in the middle with the posterior margin of the pronotum; pronotum in profile presenting the same appearance as *artabazus* (cf. fig. 43). Hairs of the mesonotum sparse and, on the whole, longer (cf. fig. 52); sculpture of the lobes less fine, the ground sculpture of the lateral ones much restricted in extent and occupying a narrow, elongate area which, however, is blurred in outline. Dorsal areas of the propodeum with strong rugosity on posterior half and traces of surface sculpture anteriorly; posterior protuberances well defined. Disc of the mesopleura with some kind of sculpture all over, though the general effect is one of broken obsolescent rugosity. Legs rather thick (fig. 75); hind coxa obscured; hind femur rather thick and rather abruptly narrowed at base; lobe of the hind tibia with 2 spines; hind tarsus 3 obviously a little shorter than 5. Recurrens of the fore-wing received into the 2nd cubital cell at a distance from the 1st transverse cubitus equal to nearly half its own length.

Petiole a little shorter. Ovipositor sheaths about as long as the whole abdomen and twice the length of the gaster.

Borneo : Sandakan, 1 ♀ (*Baker*).
Type in U.S. National Museum.

Spathius neleus sp. n.

♀. A dark red-brown species. Head and gaster chestnut red; the red of the gaster extending all over the ventral surface; thorax darker, in the propodeal region almost blackened; the mesonotum is deep shining wine red with a slightly darker flush around the sides. Antennae dark brown but reddish at base. Maxillary palpi pale yellow throughout. Front and middle coxae honey-yellow; hind coxae and hind femora (except the latter on basal $\frac{1}{4}$) brownish-red; hind tibiae brownish-red with an ill-defined yellowish band near the base; extreme base brownish-red; other legs more or less similarly coloured but the tibiae without an obvious pale area near the base. Fore-wings evenly brownish; stigma inconspicuously pale at extreme base.

Head only a little narrower behind the eyes than across them, approaching a subcubical condition, much like that of *asander* (cf. fig. 59). Face shining, with broken transverse striation, weaker along the middle. Frons with weak striation, obliterated along the middle line. Vertex completely smooth. Base of the ocellar triangle hardly wider than its sides. Antenna with 37 segments (2 ♀♀); basal segments of the flagellum clothed with dark bristling hairs which are fully as long as the width of the segments; flagellum 1 considerably longer than scape plus pedicel (fig. 99).

Thorax: Pronotal keel narrowly fused with the posterior margin of the pronotum; lateral area well defined. Mesonotum strongly shining, sloping rather gradually to the pronotum, its hairs long, almost erect and very sparse (fig. 49); middle lobe with a well-marked element of fine, vague striation right across; the striation is strongest posteriorly and tends to be slightly emphasised along the middle line; lateral lobes with well-marked rugae along each side, so that the area occupied by ground sculpture is not large but very blurred in outline; posterior carinae clearly defined. Scutellum shining, smooth, except for a trace of rugulosity on posterior third. Areation of the propodeum strong and regular; basal carina very short; ridge separating the areola from the area petiolaris sharply defined; dorsal areas a little longer than wide, very shining and virtually smooth; feeble posterior protuberances present. Legs rather slender; basal projection of the hind coxa strong and sharp; hind femur evenly narrowed from apex to base; hairs of the upper surface of the hind tibia about 1⅓ times as long as its middle width; apical lobe with 4 stout spines; hind tarsus 1 twice as long as 2; 3 is ¾ of 5. Recurrens of the fore-wing almost interstitial; nervus parallelus slightly above middle. Disc of the mesopleura shining, highly polished; furrow divided into about 6 smooth hollows, the largest of which is in the middle.

Abdomen : Petiole about 1⅔ as long as the propodeum, striate but with vague reticulation between the ridges medially. Ovipositor sheaths a trifle longer than the whole abdomen.

Length : 4·5 mm. without ovipositor.

Borneo : Sandakan, 2 ♀♀, one the type (*Baker*).

Type in U.S. National Museum.

The mesonotum of this species shows a subtle blend of features which renders it rather characteristic.

Spathius moscus sp. n.

This species is at first sight deceptively like *neleus*, from which it differs as follows :—

♀. Hind coxae, like the other two pairs, yellow; hind femora darkened only on apical half and then more especially on each side. Ventral surface of the basal half of the gaster decidedly yellowish, the pale colour rather sharply marked off from the chestnut red of the dorsal surface.

Head a trifle more transverse. Blister-like swelling above the clypeus smooth and shining; in *neleus* it is covered with feeble striations. Striation of the frons stronger, reaching the eye-margin. Antenna broken; flagellum 1 as long as scape plus pedicel.

Lateral area of the pronotum not so sharply defined along its ventral margin. Mesonotum sloping more abruptly to the pronotum (fig. 51); hairs longer, more erect; notaulices deeper, the middle lobe appearing flatter, more raised; this is largely due to the posterior carinae being extended forwards along the edge of the middle lobe; sculpture of the middle lobe finer, there being virtually no element of transverse striation; sculpture of the lateral lobes hardly different from that of *neleus*. Basal carina of the propodeum longer, nearly half the length of its forks; dorsal areas less shining, traces of ground sculpture being present. Hind coxal tooth less well developed; hairs of the upper surface of the hind tibia more erect, about twice as long as its middle width; apical lobe with only 2 spines (fig. 82). Recurrens received into the 2nd cubital cell at a distance from the 1st transverse cubitus equal to nearly ⅔ its own length.

Borneo : Sandakan, 1 ♀ (*Baker*).

Type in U.S. National Museum.

The difference in the position of the recurrens of the fore-wing in this species and *neleus* is a striking one. It is possible that the two species are less closely related than their strong superficial resemblance suggests. The species are similar in having the hind femora evenly narrowed to base, the mesopleural disc highly polished and in the paucity and smoothness of the hollows that make up the mesopleural furrow.

Spathius naupactus sp. n.

♀. Pale brownish-yellow, the body unicolorous. Legs entirely pale like the body; the hind femora are pale honey-brown, becoming still paler on about basal ¼. Maxillary palpi whitish-yellow. Fore-wing faintly and more or less evenly brownish; stigma pale on about basal ⅕.

Head approaching a subcubical condition as seen from above (fig. 62). Face very shining, with rather fine transverse striation; blister-like elevation above the clypeus smooth. Frons with irregular, mostly broken striation which reaches the eye-margin. Vertex completely smooth. Base of the ocellar triangle very slightly longer than its sides. Antenna; flagellum 1 a little longer than scape plus pedicel, 5 : 4; hairs of the flagellum conspicuous, semi-erect, clearly a little longer than the width of the segments.

Thorax: Pronotal keel very narrowly contiguous with the posterior margin of the pronotum; lateral area well defined. Mesonotum somewhat dull, sloping rather abruptly to the pronotum, its hairs outstanding, very sparse; owing to the pale colour of this sclerite, its sculpture is not readily resolvable but on the whole it is moderately strong; on the lateral lobes the area occupied by ground sculpture is small and forms a narrow longitudinal band; on the middle lobe the ground sculpture tends to be broken up by feeble raised rugulosities; posterior carinae distinct. Scutellum almost smooth. Areation of the propodeum not strong and somewhat irregular; basal carina a little less than half as long as it forks; dorsal areas shining, with feeble rugosities posteriorly and traces of ground sculpture anteriorly; ridge separating the areola from the area petiolaris distinct but weak. Disc of the mesopleura smooth, shining. Legs: hind coxa obscured; hind femur evenly narrowed to base; hind tibia slender, the hairs of its upper surface 2–3 times as long as its middle width (fig. 74); apical lobe with 1 spine; hind tarsus 1 a trifle less than twice 2; 3 only a very little shorter than 5. Recurrens received into the 2nd cubital cell at a distance from the 1st intercubitus equal to about half its own length.

Abdomen: Petiole rather long, a little more than twice the length of the propodeum, shining, with obsolescent striate-reticulation, but the striate element weak and inconspicuous. Ovipositor sheaths as long as the abdomen plus thorax, clothed conspicuously with long, outstanding bristles (fig. 91).

Length: 4·5 mm. without ovipositor.

BORNEO: Sandakan, 1 ♀ (*Baker*).

Type in U.S. National Museum.

This is a slender pale species, certainly belonging to the *asander–nearchus–neleus* complex on account of the shape of the head and the smooth vertex. The long sparse bristles of the ovipositor sheaths make it a very distinct species. It is also easily separated from its allies on colour alone.

Spathius fasciatus Walker.

Spathius fasciatus Walker, 1874, *Cist. Ent.* **1** : 307, ♀.

The type of this species, which is in the British Museum, is in poor condition, much damaged and badly mounted. It seems to be a feebly characterised insect of very generalised appearance.

♀. Head, thorax and petiole medium brown; scutellar region, a small oblong patch on inner side of each lateral lobe and the gaster paler; the gaster above shows faint yellowish bands and its ventral surface is in greater part yellowish. Legs opaque honey-yellow throughout but the hind coxae and the hind femora, as is to be expected, slightly deeper in tint; the latter are a little infuscated on each side. Wings evenly brownish; stigma pale on about basal $\frac{1}{4}$.

Head clearly a little narrower behind the eyes than across them. Face very shining, its sculpture weak and obsolescent; above the clypeus is a smooth blister-like elevation with a trace of striation on each side of it. Frons finely striate right across. Vertex completely smooth. Ocelli virtually in an equilateral triangle. Antennae missing.

Thorax: Pronotal keel feeble, medially just touching the posterior margin of the pronotum; lateral area clearly defined. Mesonotum strongly arched in front, falling almost vertically to the pronotum; hairs long and very sparse; lobes in far greater part with a fine surface sculpture; posterior carinae distinct but feeble, lying within a plexus of weak rugosities. Scutellum slightly convex, shining, almost smooth. Propodeal areation rather sharp and distinct; basal carina nearly twice as long as its forks; dorsal areas strongly shining, almost smooth; areola separated from the area petiolaris. Mesopleural furrow almost smooth on about anterior $\frac{2}{3}$; disc smooth, polished. Hind coxa with a well-defined basal projection; hairs of the hind tibiae in part rubbed off and obscured by gum; those on the upper surface of the hind tibia appear to be inclined at about 30 degrees and the longest of them are about equal to its middle width; apical lobe with 2 spines (others may have been knocked off); hind tarsus 1 twice 2; 3 is $\frac{2}{3}$ of 5. Recurrens received into the 2nd cubital cell at a distance from the 1st intercubitus equal to nearly half its own length; nervus parallelus by no means interstitial.

Petiole about $1\frac{1}{3}$ times as long as the propodeum, somewhat narrow, longitudinally strigose. Ovipositor sheaths a trifle longer than the whole abdomen.

Length: 3·5 mm. without ovipositor.

JAPAN: Unique female, type (*Coll. Walker*).

Type in British Museum (Natural History).

This species is probably fairly closely related to *neleus* and *moscus* spp. n. but differs from both in having the vestiture of the legs different and the basal carina of the propodeum longer. The feebly sculptured lobes of the mesonotum and the unicolorous legs are important for its recognition.

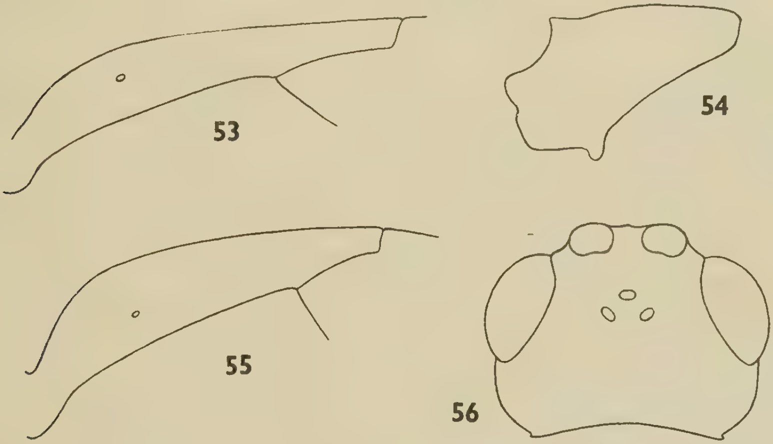
Spathius cavillator Wilkinson.

Spathius cavillator Wilkinson, 1931, *Bull. ent. Res.* **22**: 259, ♀.

♀. Head, thorax, petiole, red-brown; the mesosternum sometimes blackened; gaster brighter in colour, reddish, sometimes with a yellowish tinge. Antennae more or less honey-yellow towards base, darkened towards apex. Palpi whitish-yellow. Hind coxae brownish; front and middle coxae and all the trochanters honey-yellow; hind femora more or less tricoloured, honey-yellow at extreme base, then with a dark brown or blackish band which reaches to about half, and then the apical half red-brown; there is no sharp division between the two browns and in pale examples there is not even a differentiation into them, the femora being simply bicoloured; the other two pairs of femora are also tricoloured but less clearly so than the hind pair; hind tibiae brown at extreme base, then with a more or less colourless post-basal band reaching to one-third or two-fifths; the rest of the tibia is dark brown, becoming gradually paler to extreme apex which is almost honey-yellow; basal segment of the hind tarsus darkened and to a less extent also the following segments; in one pale individual the hind tibia is only faintly darkened in the middle and the basal segment of the hind tarsus not at all. Wings more or less evenly brownish; stigma pale on about basal third and at extreme apex.

Head transverse, only a little narrower behind the eyes than across them, but somewhat variable in this respect (fig. 56). Face with shining, transverse striation which is coarser and very wrinkly in large examples; along the weakly elevated middle line the sculpture is obliterated. Frons with strong, irregular striation everywhere; on the whole it is mostly transverse in direction. Vertex with strong striation which on anterior half and to sides of ocelli tends to lose its transverse direction in largest examples, and becomes coarse wrinkly rugosity; on posterior half, the striation is much more regular, though always subconfluent; against the occipital margin it is absent altogether; in one small individual the sculpture of the vertex is so reduced as to consist only of a trace of obsolescent transverse striation without any wrinkly rugosity. Base of the ocellar triangle clearly a little wider than its sides. Antenna with 38–41 segments (3 ♀♀); flagellum 1 a little longer than scape plus pedicel, 15 : 13; hairs of at least the three basal segments, set at about 30 degrees, shorter than the width of the segments.

Thorax: Pronotal keel contiguous or almost so with the posterior margin of the pronotum in the middle; lateral area fairly well delimited, crossed by smooth ridges. Mesonotum falling fairly steeply to the pronotum, clothed all over, densely and evenly, with short, semi-erect hairs; sculpture of the lobes on the whole rather coarse; the rugosities dense and very much broken up; on the lateral lobes only a narrow longitudinal area of fine surface sculpture is left free; the outline of this zone is also so blurred that it cannot be described as linear and its surface is closely pitted with shallow, very ill-defined punctures; on each side of the middle line of the middle lobe there is also a zone of fine sculpture; posterior ridges very sharply emphasised, much stronger than any of the surrounding rugosities. Scutellum very slightly convex, feebly sculptured, its anterior depression sometimes showing as many as four costae, usually only one, the others being broken down. Propodeum: basal carina short, almost wanting; areola separated from the area petiolaris by a well-defined keel; dorsal areas weakly shining, with traces of ground sculpture; in largest examples coarsely rugose posteriorly; rather prominent posterior protuberances present (fig. 54). Disc of the mesopleura shining, but not quite smooth, showing vague inequalities of surface and traces of puncture-like impressions. Legs: hind coxa with well-developed dentiform projection; hind tibia a little swollen on posterior two-fifths; hairs of its upper surface semi-erect, not longer than the middle width of the tibia; lobe with 5 spines; hind tarsus 1 a trifle more than twice 2, 3 a little shorter than 5, 4 : 5. Wings: recurrens received into the 2nd cubital cell at a distance from the 1st intercubitus equal to about two-fifths of its own length; subcostalis of the hind-wing a little thickened beyond the median cell.



Figs. 53–56.—53. *Spathius japenensis* sp. n., petiole, lateral; 54. *S. cavillator* Wilkinson, propodeum, not quite lateral; 55. *S. cavillator* Wilkinson, petiole, lateral; 56. *S. cavillator* Wilkinson, head, dorsal.

Abdomen: Petiole about 1½ times as long as the propodeum, in profile considerably thickened just anterior to middle (fig. 55); with a few longitudinal ridges and irregular reticulations. Ovipositor sheaths about as long as the gaster.

Length: 4·2–5·5 mm. without ovipositor.

INDIA: U.P., Dehra Dun ex wood of *Acacia catechu* and *Terminalia belerica*; Bengal, Jalpaiguri, ex wood of *Garuga pinnata*, Kalimpong; Bombay, N. Thana.

Hosts: *Mecistocerus fluctiger* Fst. and other CURCULIONIDAE.

Type in British Museum (Natural History).

I also refer to this species a single female (Bombay, W. Thana, Kanchad, ex wood of *Acacia catechu*) which is about 4·2 mm. in length and has the hind femur bicoloured, dark brown, except for the pale band; the subcostalis beyond the median cell of the hind-wing is more noticeably thickened.

Spathius japenensis sp. n.

This species is extremely closely related to *cavillator*, from which it differs as follows:—

♀. Much darker in colour, the thorax and petiole more or less uniformly dark brown; there is a faint touch of dull red around the origin of the notaulices and beneath the wing insertions; the propodeum appears virtually black; head a little paler than the thorax, somewhat yellowish across the frons and along the inner orbits; gaster dark brown, except for tergites 7 and 8 and a very ill-defined band in front of tergite 7, all of which are more or less honey-yellow. Hind coxae very dark brown but honey-yellow at extreme apex; hind femur bicoloured, honey-yellow at extreme base, otherwise very dark brown, the colour deeper than in *cavillator* Wilk.; hind tarsus dark brown throughout. Wings darker brown; stigma less extensively pale at base and not at all at apex; hairs of the flagellum darker.

Head slightly less narrow behind the eyes. Striation of the vertex more regular, anteriorly only very slightly wavy.

Hairs of the mesonotum a little longer; raised rugosities stronger, less broken; longitudinal zone of fine sculpture on lateral lobes with hardly a trace of punctures. Scutellum smoother, more shining, its anterior depression with three strong costae. Hairs of the upper surface of the hind tibia a little longer. Radius leaving stigma very slightly before middle; in *cavillator* it arises very slightly beyond middle; 2nd abscissa of the radius longer; recurrens received into the 2nd cubital cell at a distance from the 1st intercubitus equal to about one-fifth its own length (some variation should be expected in this last respect); subcostalis of the hind-wing not noticeably thickened beyond the apex of the median cell (that is, not over and above what is normal).

Petiole longer, narrower and in profile less swollen in the region of the spiracles (fig. 53). Ovipositor sheaths longer, about as long as the abdomen plus propodeum.

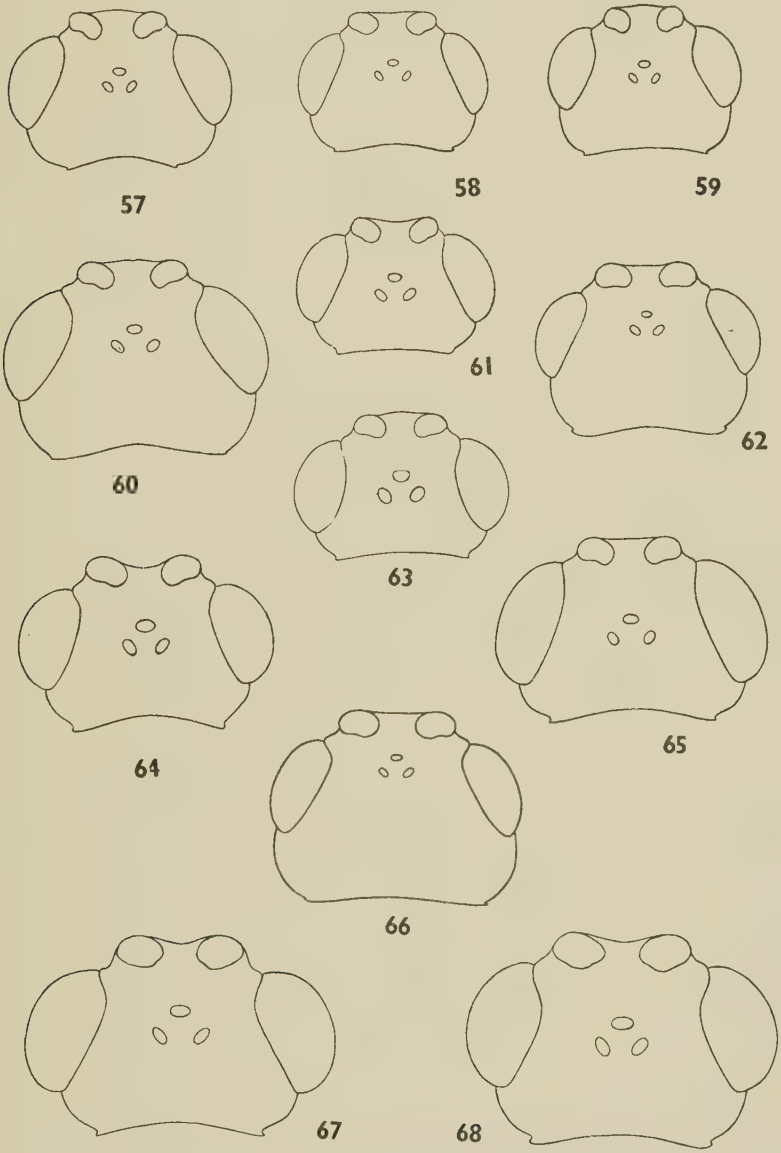
NORTH DUTCH NEW GUINEA: Japen, 500 ft., xi.1938, 1 ♀ (*L. E. Cheesman*).

Type in British Museum (Natural History).

Obviously the most easily appreciated differences between the two species, if *japenensis* really is a good species and not merely a geographical race of *cavillator*, are the colour and longer ovipositor of the former insect. In any case, whether *japenensis* is specifically distinct or not, it still remains interesting as throwing some light on the distribution of *cavillator* itself on the one hand or of the *cavillator*-group as a whole on the other.

Spathius sabronensis sp. n.

♀. A species appearing mostly pale brownish-yellow to the naked eye. Head pale testaceous yellow suffused with darker colouring in the oral region; following parts of the thorax pale brownish-yellow :—sides of the pronotum, except for a large brown anterior area which spreads over the collar, mesonotum, except for a slight suffusion of darker colouring within the posterior depression, propodeum, except within the areola which is



Figs. 57–68.—Head dorsal :—57. *Spathius artabazus* sp. n.; 58. *S. asclepiades* sp. n.; 59. *S. asander* sp. n.; 60. *S. elagabalus* sp. n.; 61. *S. dolon* sp. n.; 62. *S. naupactus* sp. n.; 63. *S. aphareus* sp. n.; 64. *S. gades* sp. n.; 65. *S. iphitus* sp. n.; 66. *S. sabronensis* sp. n.; 67. *S. epaphus* sp. n.; 68. *S. colophon* sp. n.

faintly suffused with brown, the entire disc of the mesopleura but excluding the furrow, and metapleura except on lower half. Scape, pedicel and to a less extent the 1st flagellar segment, yellowish; the flagellum thence becoming gradually brown to the 31st segment (rest broken off). All the coxae yellow; femora honey-yellow, feebly darkened over most of their medial surface; hind tibiae with a dark band in the middle and with a postbasal whitish-yellow band. Gaster in a dorsal view mostly dark brown but ivory white are (fig. 39) a large spot on each side of the basal half of tergite (2 + 3) and an indistinct band across the apical half; apical margin of 5 and whole of tergites 6–8; ventral surface pale except for a large brown patch just beyond middle and a sharply discrete brown patch on the epipleura of tergite (2 + 3). Wings faintly and evenly brownish; basal third of stigma, its extreme apex, metacarp, 2nd and 3rd abscissae of the cubitus, yellowish.

Head seen from above subquadrate, not narrower behind the eyes than across them (fig. 66). Face with fine, broken, transverse striation, obliterated along the weak, medial elevation. Frons rather finely transversely rugose. Vertex on anterior half with transverse striation which for the most part is fine and smooth but within the area between the ocelli and the eye becomes very wrinkly. Ocelli placed unusually far forward on the vertex (fig. 66), almost in an equilateral triangle. Flagellum 1 unusually long, 1½ times as long as scape plus pedicel and 1½ times as long as flagellum 2 (fig. 97); hairs of the flagellum blackish, dense, shorter than the width of the segments.

Thorax: Pronotal keel widely fused with the posterior margin of the pronotum and very indistinct where it is free; lateral area very indistinct. Mesonotum clothed everywhere densely with fine, very short, more or less recumbent hairs; its middle lobe falls perpendicularly to the pronotum; sculpture of the lobes, on the whole, fine but consisting chiefly of raised rugulosities; the usual fine ground sculpture of scaly-reticulation occurs along the middle part of the lateral lobes but is not confined to a linear zone; posterior ridges well emphasised but irregular and more or less parallel; the fine broken ridges which occur on the inner side of the lateral lobes are obliquely placed and have a forward direction. Scutellum decidedly a little convex, shining, and with a trace of obsolescent punctation. Propodeum: basal carina half as long as its forks; areola separated from the area petiolaris by a well-defined ridge; dorsal areas sharply delimited, their surface very shining, there being hardly a trace of ground sculpture and the bounding carinae themselves giving off only a few, quite inconspicuous branches; the areola is quite thickly pubescent; weak posterior protuberances present. Disc of the mesopleura with somewhat obsolescent punctate-striation. Legs: hind coxa with a feeble but distinct projection; hind femur normal; hind tibia hardly swollen at base; hairs of its upper surface semi-erect, irregular in length, the longest of them only a little longer than the middle width of the tibia; apical lobe with a complete row of spines, 7 in number; fringe 2–3; hind tarsus 1 twice 2; 3 as long as 5; spines along the upper surface of front and middle tibiae very strong and conspicuous. Recurrens nearly interstitial. Sides of the thorax thickly hairy everywhere.

Abdomen: Petiole slightly less than twice as long as the propodeum, with a few longitudinal, beyond middle a little confluent, ridges. Ovipositor sheaths about one and one-third times as long as the gaster.

Length: 4·5 mm. without ovipositor.

DUTCH NEW GUINEA: Cyclops Mts., Sabron, 930 ft., vi.1936, 1 ♀ (*L. E. Cheesman*).

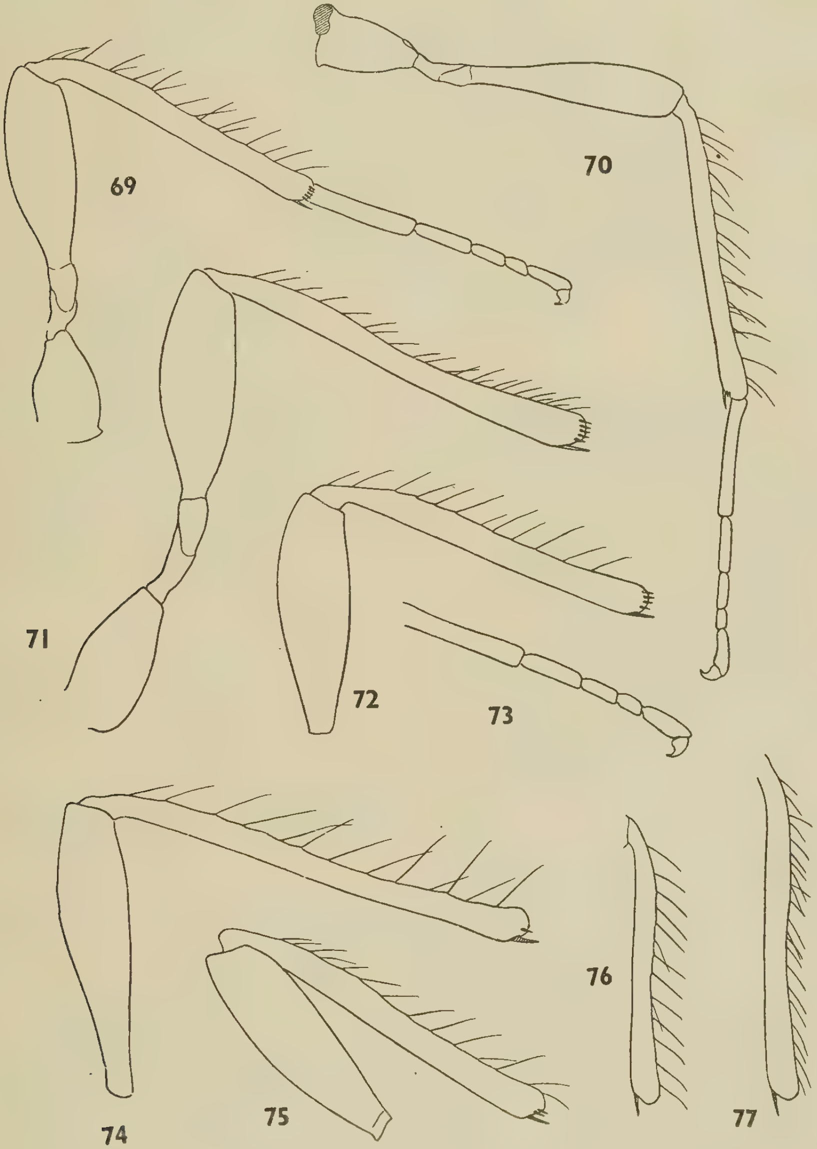
Type in British Museum (Natural History).

This is a very distinctive species, not to be confused with any other with smooth gaster. It appears to be isolated and is largely characterised by the shape of the head, as seen from above, position of the ocelli, long 1st flagellar segment, in combination with the unusual hairiness of the thorax.

Spathius dolopes sp. n.

♀. Rich brownish-red, the thorax and petiole with a purplish tint to the naked eye; the gaster sometimes with a yellowish tint. Apical flagellar segments 8–9 clear yellow.

Front and middle coxae and trochanters of all the legs yellowish; legs otherwise reddish. Extreme base of the stigma faintly yellowish.



FIGS. 69–77.—69. *Spathius polydectes* sp. n., hind leg, ♀; 70. *S. psammenitus* sp. n., hind leg, ♀; 71. *S. carinus* sp. n., part of hind leg, ♀; 72. *S. asander* sp. n., part of hind leg, ♀; 73. *S. asander*, hind tarsus, ♀; 74. *S. naupactus* sp. n., part of hind leg, ♀; 75. *S. lissus* sp. n., part of hind leg, ♀; 76. *S. anytus* sp. n., hind tibia, ♀; 77. *S. aphareus* sp. n., hind tibia, ♀.

Head strongly transverse, considerably narrower behind the eyes than across them, the eyes hence rather prominent. Face transversely rugose on each side of a weak, nearly smooth, medial elevation. Frons and vertex, except the posterior, declivous part of the latter, intersected by very coarse rugosities, those on the vertex being predominantly transverse in direction (fig. 80); posterior declivous part of the vertex, temples and cheeks posterior to the genal sulcus, completely smooth, except for minute punctures from which the sparse hairs arise. Antenna with about 45–50 segments; flagellum 1 as long as scape plus pedicel; the entire flagellum clothed with stiff, bristle-like hairs, set at about 45 degrees and fully as long as the width of the segments (fig. 100). Base of the ocellar triangle clearly longer than its sides.

Thorax: Pronotal keel completely free (fig. 48); in a lateral view of the thorax, it lies well below the level of the posterior margin of the pronotum; lateral area crossed by 4–5 smooth ridges. Mesonotum everywhere with very coarse, shining rugosities; those on the middle lobe form strong, mostly complete, transverse ridges; on the lateral lobes there is a faint indication of a mid-longitudinal linear elevation breaking the continuity of the transverse sculpture (fig. 79); posterior ridges present but irregular in outline; hairs rather numerous, especially on the lateral lobes where numerous short hairs are mixed with the longer ones (fig. 93). Scutellum nearly flat, posteriorly with a few transverse rugae. Propodeum with sharply defined areation; basal carina very short; areola with shining transverse rugae; area petiolaris separated from the areola by a short crest-like ridge; dorsal areas virtually smooth, except for short rugae which branch off from the bounding keels; sometimes these branches join to form transverse keels. Mesopleura usually everywhere intersected by shining rugosities; rarely the disc above the furrow nearly smooth; further, the disc has only sparse erect hairs or is nearly bare; surface between the furrow and the medial suture of the mesosternum without sulcation. Legs: hind coxa with a blunt projection at base; hind femur gradually and evenly narrowed to base (fig. 87); lobe of the hind tibia with 3–4 spines; hairs of the upper surface of the hind tibia about twice its middle width; hind tarsus 1 very slightly more than twice 2, 23 : 11; 3 is $\frac{2}{3}$ of 5. Wings (fig. 102); recurrens almost interstitial.

Abdomen: Petiole about twice as long as the propodeum, markedly narrowed from the spiracles to just beyond the apical dilatation; beyond the spiracles shining and almost smooth (fig. 37). Tergite (2 + 3) without a trace of a lateral margin. Ovipositor sheaths about as long as the thorax plus abdomen.

Length: 6–7 mm. without ovipositor.

Philippines: Mindanao, Butuan, 4 ♀♀ (*Baker*); Dapitan, 1 ♀ (*B.*). Luzon, Mt. Makiling, 2 ♀♀ (*Baker*); Cagayan, 1 ♀, the type (*Baker*). Los Baños, 2 ♀♀ (*B.*).

Type in U.S. National Museum.

Spathius chersonesus sp. n.

Differs from *dolopes* as follows :—

♀. Dark brown, the thorax appearing blackish to the naked eye; head, petiole and gaster rich coffee brown. Flagellum dark brown throughout. All the femora brown, the tibiae brown except at extreme apex which is yellowish. Base of the stigma less determinately yellowish.

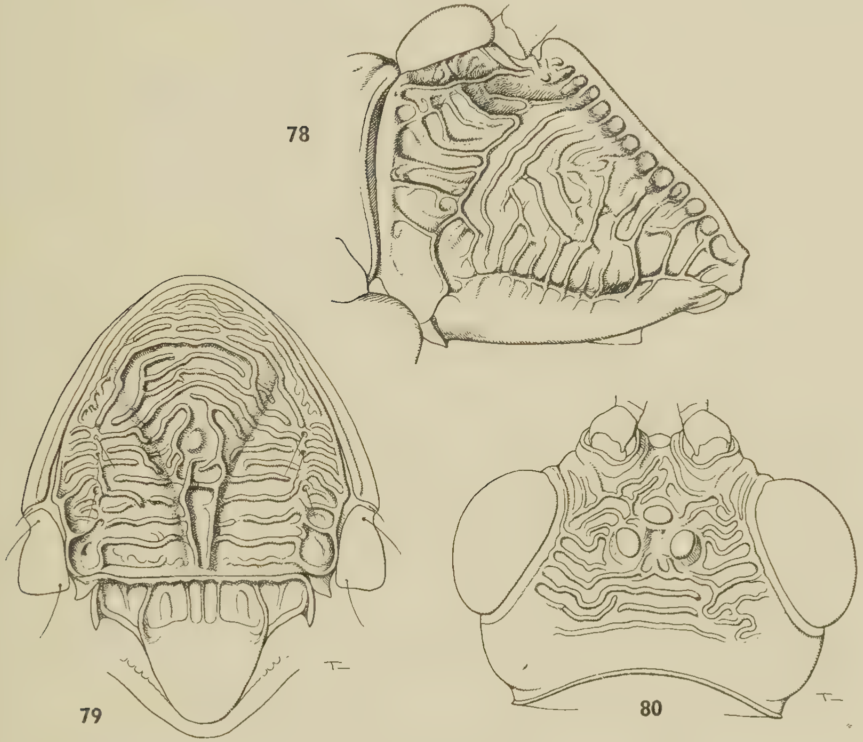
Head slightly less narrowed behind the eyes, the eyes hence not quite so prominent. Antenna with 56 segments; bristle-like hairs of the flagellum less erect and very slightly shorter. Hairs of the upper surface of the hind tibia very slightly longer. Rugosities of the mesopleura decidedly stronger and coarser (fig. 78). Ovipositor sheaths fully as long as the whole body.

Length: 7·5 mm. without ovipositor.

Philippines: Luzon, Mt. Makiling, 1 ♀ (*Baker*).

Type in U.S. National Museum.

This species differs from *dolopes* very strikingly in colour.



Figs. 78–80.—78. *Spathius chersonesus* sp. n., mesopleura; 79. *S. dolopes* sp. n., mesonotum; 80. *S. dolopes*, head, dorsal.

Spathius busirios sp. n.

Differs from *dolopes* as follows :—

♀. Tibiae, especially the front and middle pairs, decidedly darkened, the front and middle pairs also yellowish at apex. Stigma brown throughout.

Face on each side of the medial elevation much less rugose, the rugosities so much weaker that the surface is describable as feebly but irregularly punctate. Antenna broken but with at least 42 segments, the apical 6 of which are pale yellow. Mesonotum much less shining, owing to a dense vestiture of short whitish pubescence. Disc of the mesopleura with fine pubescence similar to that of the mesonotum. Propodeum very pubescent, slightly shorter; ridge between the areola and the area petiolaris much more prominent, labiform; prominent posterior protuberances present, blackened. Hairs of the upper surface of the hind tibia a trifle shorter. Ovipositor shorter, its sheaths about 1¼ times as long as the whole abdomen.

Length: 7·5 mm. without ovipositor.

Borneo: 1 ♀ (*Baker*).

Type in U.S. National Museum.

This and the two preceding species (*dolopes* and *chersonesus*) are certainly very closely related, all three being characterised within the larger group to which they belong by having the hind femur unicolorous and gradually narrowed to base.

Spathius drymus sp. n.

Differs from *dolopes* as follows :—

♀. All the coxae and trochanters (except the narrow articulation between the apical trochanter and the femur) yellow; hind femora yellow on basal ⅓, otherwise pale brownish-red; hind tibiae brownish-red at extreme base, then with a wide yellowish basal band; otherwise pale honey-brown with a reddish tint.

Posterior declivous part of the vertex with short, shining longitudinal rugae placed at right angles to the occipital margin; anteriorly these rugae merge into the mostly transverse rugosity of the vertex. Antenna with 35–37 segments.

Rugosities of the middle lobe of the mesonotum, though covering the entire surface, much broken; by no means forming complete transverse ridges. Scutellum with rugae over all its surface. Posterior protuberances of the propodeum a little more prominent than in *dolopes*. Rugosity of the mesopleura slightly stronger and more definite. Hind femur a little less evenly narrowed to base.

Petiole much shorter, 1½ times as long as the propodeum, covered with obsolescent longitudinal rugae, the intervals vaguely rugose or foveolate. Ovipositor much shorter, about ¾ the length of the whole abdomen.

Length : 4–5 mm. without ovipositor.

Philippines : Luzon, Mt. Makiling, 1 ♀, the type (*Baker*). Mt. Banahao, 1 ♀ (*Baker*). Los Baños, 1 ♀ (*Baker*).

Type in U.S. National Museum.

Although I have compared this species with *dolopes*, it resembles *cheops* sp. n. more closely because of the form of the hind femur and colour of the legs and short ovipositor. It differs from *cheops* as shown in the key.

Spathius cheops sp. n.

♀. Red-brown; thorax with a purplish tint to the naked eye; gaster to the naked eye faintly banded with yellow. Antenna only very slightly paler at base, at first sight brownish throughout. All the coxae and trochanters honey-yellow; hind femora yellow at extreme base, otherwise reddish; hind tibiae with a rather ill-defined pale brownish band in the middle; proximal and distal to this band honey-yellow, but extreme base brown; front and middle femora yellowish with a faint brownish tinge. Stigma yellowish on basal ⅕.

Head seen from above like that of *dolopes* (cf. fig. 80). Face with a feeble smooth longitudinal elevation, otherwise transversely rugose. Frons covered with coarse shining rugae. Anterior half of the vertex with strong transverse rugosities, forming deep sub-confluent sulcation; posterior declivous part of the vertex and head behind the eyes, virtually smooth, polished. Antenna with 46 segments; flagellum covered with stiff, bristle-like hairs which are as long as the width of the segments; flagellum 1 as long as scape plus pedicel. Base of the ocellar triangle clearly longer than its sides.

Thorax : Sculpture of the pronotum and of mesonotum and vestiture of the latter as in *dolopes*, but the posterior carinae of the mesonotum hardly defined as such. Intersecting rugosities of the mesopleura stronger than in *dolopes*, sharply defined; between the mesopleural furrow and the medial suture of the mesosternum is a longitudinal band of short parallel ridges, which, towards the posterior end of the sclerite, become continuous with the ridges which cross the mesopleural furrow. Propodeum as in *dolopes*. Recurrens received into the 2nd cubital cell at a distance from the 1st intercubitus equal to about ¼ its own length. Projection at base of hind coxa very feeble; hairs of the upper surface of the hind tibia about 1½ times as long as its middle width; apical lobe with 2 inconspicuous spines; hind tarsus 1 twice 2; 3 is ⅔ of 5.

Abdomen : Petiole nearly twice as long as the propodeum, not noticeably constricted beyond the middle, clearly wider at extreme apex than at spiracles (fig. 38); apical to the spiracles longitudinally sulcate, the furrows in part broken up to form oblong pits. Tergite (2 + 3) without a trace of a lateral margin. Ovipositor sheaths about as long as the abdomen plus propodeum.

Length: 5 mm. without ovipositor.

PHILIPPINES: Luzon, Mt. Makiling, 1 ♀, the type (*Baker*). Mt. Banahao, 1 ♀ (*Baker*).

Type in U.S. National Museum.

Spathius echemus sp. n.

This species is closely related to *cheops* and *drymus* spp. n. As *cheops* has been described in full, I will compare *echemus* with it:—

♀. Head pale brownish-yellow, the lower part of the face and of the cheeks heavily embrowned; there is also a small brown patch behind each eye and the occiput is brownish almost all over; mesonotum pale brownish-yellow (to the naked eye); rest of the thorax medium brown, considerably darker than the mesonotum and with a reddish flush. Flagellum yellowish towards base but the pedicel darker. Hind coxae dark brown; hind femora dark brown, sharply yellowish on basal third; band at middle of hind tibiae deeper brown; front and middle femora like the hind pair, darker than in *cheops*.

Disposition of sculpture of frons like that of *cheops* but the sulcation weak, subobsolescent. (Antenna broken.)

Sculpture of mesonotum different, the rugae of the middle lobe being broken up to form merely coarse rugosity without a marked transverse tendency; altogether the impression given is one of intricate rugosity; hairs of the mesonotum denser, more numerous. Dorsal areas of the propodeum with rather more raised rugosity and less shining. Hairs of the upper surface of the hind tibia a trifle longer; apical lobe with 6 close spines.

PHILIPPINES: Los Baños, 1 ♀ (*Baker*).

Type in U.S. National Museum.

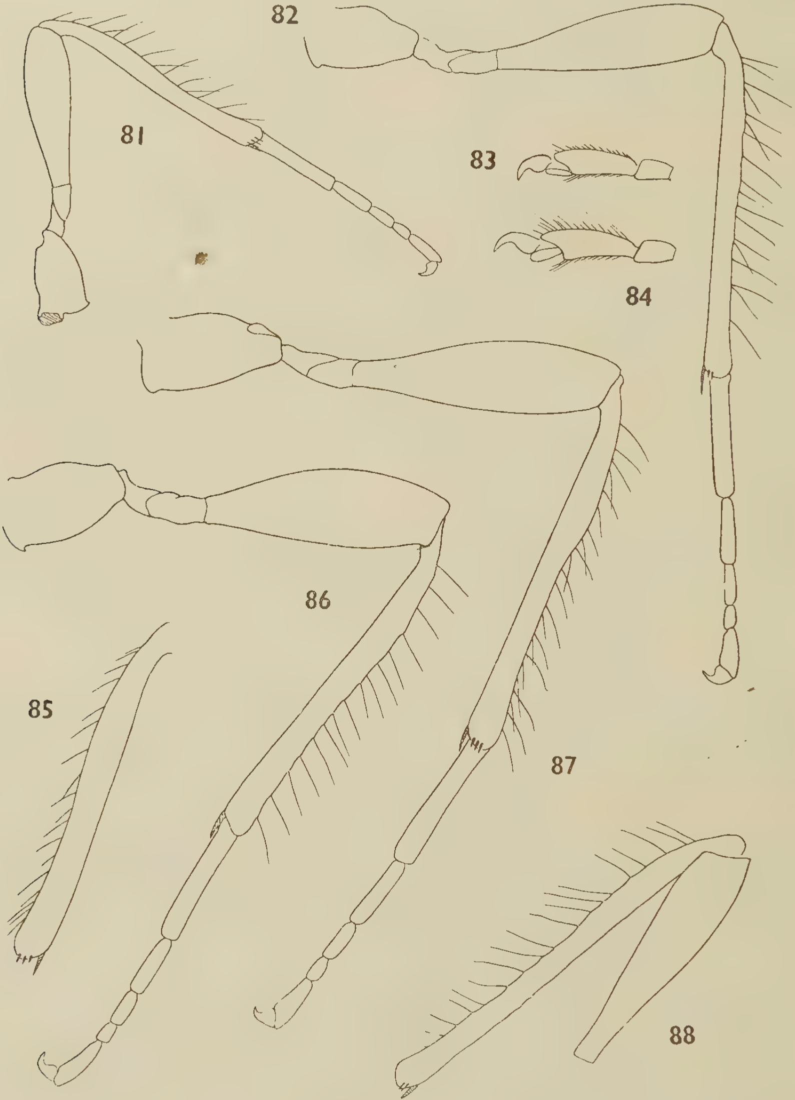
This species also closely resembles *drymus* but differs at once in the colour of the head and of the hind coxae.

Spathius eridamus sp. n.

♀. Brownish-yellow; the head and the gaster more yellowish than the other parts of the body. Antenna dark brown for the existing 26 segments, contrasting rather sharply with the yellowish head. Palpi pale yellow. Hind coxae suffused with brown; hind femora more or less honey-brown, very slightly darker towards the base on each side; hind tibiae pale honey-yellow with a brownish band in the middle. Wings faintly smoky; stigma pale on basal $\frac{1}{3}$.

Head much narrower behind the eyes than across them (fig. 28). Face very shining, with traces of obsolescent transverse rugosity. Frons and vertex completely smooth. Ocelli virtually in an equilateral triangle. Antenna: flagellum 1 a trifle shorter than scape plus pedicel, 9 : 10; flagellum densely beset with semi-erect hairs which are about as long as the width of the segments.

Thorax somewhat flattened, the mesonotum not lying high above the level of the pronotum (fig. 45). Pronotum somewhat elongate, its keel well developed, widely separated from the posterior margin; lateral area only weakly emphasised. Mesonotum sloping very gradually and feebly to the pronotum; thickly and evenly clothed with mostly short, recumbent hairs but with a few longer, more erect hairs mixed; lobes with thick, transverse, slightly broken ridges all over; posterior carinae well defined, even. Scutellum shining, virtually smooth. Basal carina of the propodeum about $\frac{1}{2}$ as long as its forks; areola clearly defined, completely separated from the area petiolaris; posterior protuberances rather prominent; dorsal areas shining, rugose-reticulate except anteriorly where the surface shows traces of scaly-reticulation. Mesopleura intersected everywhere by irregular ridges and rugosities. Legs with rather conspicuous long bristling hairs, those of the upper surface of the hind tibia nearly erect, nearly twice as long as its middle width; hind coxa bluntly rounded beneath at base; apical lobe and hind tarsi obscured by gum. Recurrens more or less interstitial.



Figs. 81–88.—81. *Spathius helle* sp. n., hind leg, ♀; 82. *S. moscus* sp. n., hind leg, ♀; 83. *S. gades* sp. n., apical segment of hind tarsus; 84. same of *S. lynceus* sp. n.; 85. *S. seres* sp. n., hind tibia, ♀; 86. *S. colophon* sp. n., hind leg, ♀; 87. *S. dolopes* sp. n., hind leg, ♀; 88. *S. leptothecus* Cameron, part of hind leg, ♀.

Abdomen: Petiole rather short, only a little longer than the propodeum, about 16 : 13, with fairly even ridges, except at the apical dilatation, which is smooth. Ovipositor sheaths as long as the gaster.

Length: 3·8 mm. without ovipositor.

PHILIPPINES: Luzon, Mt. Makiling, 1 ♀ (*Baker*).

Type in U.S. National Museum.

This species and the next (*metris* sp. n.) are probably fairly closely related to the *dolopes* complex on account of the structure and sculpture of the thorax and the position of the recurrent nervure of the fore-wing; they differ from all the species in this complex because of the smooth vertex and the very gradual anterior slope of the mesonotum. Specifically, *eridamus* seems to be characterised by its smooth frons in combination with the sculpture and vestiture of the mesonotum.

Spathius metris sp. n.

This species has an exactly similar facies to that of *eridamus* sp. n. and is extremely closely related to that species. It differs from *eridamus* as follows: —

♀. Head of a less clear yellow, more transparent whitish; a very distinct brown patch behind each eye, prolonged to form an obscure patch across the occiput; behind the ocelli a rather indistinct wedge-shaped brownish mark; gaster a little more reddish in tint. Antenna dark brown but the flagellum a little paler towards the base; the scape and pedicel are darker than these basal flagellar segments and contrast sharply with the pale head, as in *eridamus*. All the coxae very pale yellow; hind femora more or less yellowish but faintly darkened on each side towards apex; hind tibiae pale yellow throughout, except that at extreme base they are faintly brownish.

Face almost completely smooth. Frons with feeble transverse striation. Ocelli arranged in a triangle slightly less nearly equilateral. Flagellum 1 exactly as long as scape plus pedicel.

Pronotal keel slightly less well developed and at middle feebly angled towards the posterior margin of the pronotum. Hairs of the mesonotum considerably less numerous, all longer and more outstanding; transverse rugae of the mesonotum less dominant; on each side of the middle line of the medial lobe there is a linear zone of scaly-reticulation on to which the transverse shining rugae encroach. Dorsal areas of the propodeum with less raised rugosity posteriorly. Disc of the mesopleura almost smooth. Hind coxa with a distinct dentiform projection; hairs of the upper surface of the hind tibia very slightly shorter and less erect; apical lobe of the hind tibia with 2 very small spines; hind tarsus 1 twice 2; 3 is ⅔ of 5. Recurrens of the fore-wing very distinctly not interstitial.

Petiole a little thicker, its ridges extending almost to apical margin. Ovipositor sheaths shorter, a little thicker, about ⅔ as long as the gaster.

PHILIPPINES: Mindanao, Zamboanga, 1 ♀ (*Baker*).

Type in U.S. National Museum.

The most easily appreciated differences between this species and *eridamus* are the dark patches behind the eyes and the pale hind coxae of *metris*.

Spathius gentius sp. n.

♀. Head, thorax, and petiole very dark brown, almost black; the head is slightly less dark than the thorax; gaster bright chestnut-red. Antennae dark brown, paler towards the base. Palpi whitish-yellow. Front and middle coxae more or less honey-yellow; hind coxae blackish; all the femora deep wine red; tibiae blackish, almost yellowish at extreme apex, the hind pair with strong reddish tint on apical half; basal trochanter and most of the apical trochanter yellowish.

Head rather strongly transverse, not narrower behind the eyes than across them, not much narrowed towards the occipital margin. Face coarsely transversely rugose, with a weakly indicated, less rugose median elevation. Frons coarsely striate-rugose. Vertex polished and smooth except for a few widely scattered punctures from which the hairs arise. Base of the ocellar triangle a little longer than its sides. Antenna with 62 segments in the type; flagellum 1 as long as scape plus pedicel, markedly longer than 2, 13 : 9, clothed with short hairs which on the more basal segments are hardly more than half the width of the segments themselves.

Thorax: Pronotal keel feeble, almost touching the posterior margin of the pronotum and for a considerable distance; lateral area clearly defined, with smooth transverse ridges. Mesonotum strongly arched in front, falling almost vertically to the pronotum; hairs decidedly numerous; lobes almost everywhere with coarse more or less transverse rugosities which, on lateral lobes, leave free a medial linear area which is almost smooth and feebly elevated; posterior carinae well defined, nearly parallel. Scutellum polished, feebly convex, with a few shallow foveae. Propodeum strongly shining and with a good deal of strong rugosity; basal carina about $\frac{1}{3}$ as long as its forks; dorsal areas shining, with strong transverse rugae on about posterior half; areola rather irregular in outline, separated from the area petiolaris by a ridge which is not more emphasised than any of the adjacent ridges. Mesopleura everywhere intersected by strong ridges and broken reticulation. Hind coxa with a well-developed basal projection; hairs of the upper surface of the hind tibia about $1\frac{1}{2}$ times as long as its middle width; lobe with a complete row of spines; hind tarsus 1 a little more than twice 2, 9 : 4; 3 is $\frac{2}{3}$ of 5. Recurrens almost interstitial; nervus parallelus by no means interstitial; 1st abscissa of the radius forming a distinct angle with the 2nd.

Abdomen: Petiole nearly twice as long as the propodeum, with obsolescent reticulation and foveae except within the apical dilatation which is smooth. Ovipositor sheaths a little shorter than the thorax plus abdomen.

Length: about 8 mm. without ovipositor.

♂. Like the female except that the head is paler, almost red-brown with a darker suffusion on the lower part of the face; the gaster is darker in the middle but paler along the sides and apical margin. The hind tibiae have a conspicuous pale ring at base but are dark at extreme base; this pale area is present on the other two pairs of tibiae but is much less bright. Length: 7 mm.

PHILIPPINES: I. of Samar, 3 ♀♀, one the type, 1 ♂ (*Baker*).

Type in U.S. National Museum.

This is a very handsome and distinctive species, separable on colour alone from all the other species with smooth gaster. The strongly sculptured mesopleura, marked hairiness of the mesonotum, short basal carina of the propodeum, nearly interstitial recurrens and the complete row of spines on the apical lobe of the hind tibia, all suggest a relationship with the sub-group of *dolopes*; but all the members of this sub-group have coarse sculpture on at least the anterior part of the vertex, the pronotal keel quite free and the petiole usually much lengthened.

Spathius gentius var. **unicolor** var. n.

♀. Distinguishable from the nominotypical form by being entirely of a rich reddish colour with the gaster somewhat yellowish beneath. The hind coxae are red like the body; the tarsi are more or less red; the tibiae are as in the typical form.

Philippines : Luzon, Altimonan, 1–8.viii.1908, 1 ♀, the type (*Micholitz*).
Type in British Museum (Natural History).
This is a most conspicuous-looking insect.

Spathius eclectes sp. n.

This species is very closely related to *gentius* (differing chiefly from it in colour) and may be only a race of it. It may be compared with *gentius* as follows :—

♀. Rich brownish-red with a purplish tint on thorax; a suffusion of darker colouring similar to that of the thorax occurs on tergite (2 + 3). Base of the flagellum a little darker than scape and pedicel (in *gentius* there is no such contrast). Hind coxae and all the femora brownish-red; hind tibiae more or less the same colour as their femora but slightly darkened just posterior to middle and with a pale, ill-delimited, yellowish area almost at base.

Eyes markedly prominent, the head clearly wider across them than behind them, 7 : 6. The eye is surrounded by a weak furrow (more distinct behind) which tends to enhance the prominent appearance of the eye. Face slightly less coarsely rugose, the transverse element hence more in evidence. Antenna with 49 segments; flagellum more slender, its hairs thicker, longer and more bristly.

Pronotal keel somewhat weak, angularly indented backwards, the point of the indentation virtually touching the posterior margin of the pronotum (cf. *gentius*). Hairs of the mesonotum considerably sparser. Scutellum almost flat. Basal carina of the propodeum shorter, only ½ as long as its very irregular forks. Lobe of the hind tibia with 4 spines—in *gentius* there are 7. First abscissa of the radius of the fore-wing almost in a straight line with the 2nd.

Petiole less constricted before apex and with a much more obvious longitudinal element in the sculpture.

Length : 5·5 mm. without ovipositor.

Philippines : Cuernos Mts., 1 ♀, the type (*Baker*).
Type in U.S. National Museum.

Spathius colophon sp. n.

♀. Head pale brownish-yellow; thorax brownish-red to the naked eye with a slightly purplish tint; petiole blackish; gaster more or less chestnut brown. About apical 12 segments of the flagellum bright yellow. All the coxae honey-yellow; hind femora honey-yellow with a slight reddish suffusion on each side just beyond middle; hind tibiae virtually unicolorous, honey-yellow.

Head strongly transverse, much narrower behind the eyes than across them (fig. 68). Eyes prominent. Except for a medial shining, more or less smooth elevation, the face is strongly transversely rugose. Frons with strong, smooth, even striation which is sometimes narrowly interrupted along the middle line of the frons. Vertex with strong transverse subconfluent striation which extends on to the posterior declivous part of the vertex but is absent immediately against the occipital margin; in one of the two females from Sandakan, the striation is very even and sharp. Antenna with 44 segments (type); entire flagellum beset with bristly hairs which are set at about 45 degrees and are fully as long as the segments are wide. Base of the ocellar triangle very clearly longer than its sides. Cheeks completely smooth.

Thorax : Pronotal keel rather weak but separated from the posterior margin of the pronotum by a distinct space; lateral area very shining, crossed by about 6 smooth ridges. Hairs of the mesonotum long and sparse; longer and much sparser than in the subgroup of *dolopes*; middle lobe of the mesonotum with a thin medial line of raised rugulosities; on each side of this is a very ill-defined band of fine subscaly-reticulation; rest of the surface of the middle lobe with shining rugosities; lateral lobes with shining rugosities except for a feebly elevated band of fine surface sculpture; posterior carinae present, very wrinkly and nearly parallel. Scutellum smooth, flat. Basal carina of the propodeum less than half as long as its forks; areola separated from the area petiolaris by a well-developed ridge; dorsal areas, except for a few rugae around the sides, shining and polished. Entire disc of the mesopleura smooth and polished; the furrow foveate; posterior margin foveate. Legs: hind coxa with a sharp projection beneath; hind femur normal (fig. 86); seen from the side, the hind tibia is feebly serrated where the hairs arise and not noticeably swollen at base; the hairs of its upper surface twice its middle width; apical lobe without spines; hind tarsus 1 fully twice 2; 3 about ⅔ of 5. Recurrens received into the 2nd cubital cell at a distance from the 1st intercubitus equal to about ⅖ its own length; 2nd abscissa of the radius as long as the 1st transverse cubitus.

Abdomen: Petiole not quite twice as long as the propodeum and with some sort of rugosity everywhere. Gaster smooth and shining but in one female from Singapore there is a faint trace of striation on each side at base. Ovipositor sheaths a little shorter than thorax plus abdomen.

Length: 5 mm., approx., without ovipositor.

BORNEO: Sandakan, 2 ♀♀ (*Baker*). MALAYA: Singapore, 3 ♀♀, one the type (*Baker*). PHILIPPINES: Palawan, Puerto Princesa, 1 ♀ (*Baker*).

Type in U.S. National Museum.

The female from Puerto Princesa agrees in all respects with those from Singapore and Sandakan.

Spathius colophon subsp. **butuanensis** subsp. n.

I am fairly well satisfied that this is a geographical form of *colophon*; the differences lie mainly in venation and colour and are as follows:—

♀. General coloration fairly evenly reddish; head hardly paler than the thorax; petiole reddish like the thorax. Apical segments of the flagellum only faintly paler than the others. Hind coxae reddish; hind femora, except for the yellowish base, also reddish; hind tibiae honey-brown but becoming honey-yellow on about basal ⅓; hind tarsi dark brown, contrasting rather sharply with the paler tibiae.

Sculpture of the vertex coarser, almost transversely striate-reticulate; in five out of six females, the declivous part of the vertex immediately against the occipital margin is virtually smooth, but in the remaining female, the surface here shows short, strong, longitudinal costae. Scutellum weakly transversely rugose and with clear indication of surface sculpture. Hairs of the upper surface of the hind tibia a little shorter; apical lobe with 2 spines near the shorter spur. Recurrens entering the 2nd cubital cell at a point a little nearer the transverse cubitus; 2nd abscissa of the radius clearly longer than the 1st transverse cubitus.

PHILIPPINES: Mindanao, Butuan, 6 ♀♀, one the type (*Baker*).

Type in U.S. National Museum.

Spathius leptoceras Cameron.

Spathius leptoceras Cam., 1908, *Dtsch. ent. Z.* **1908**: 689.

♀. Head pale brownish-yellow with a darkened area behind each eye and on each side of the occiput; thorax brownish, a little blackened within the anterior depression of the scutellum, the subalar impression, the furrow of the mesopleura and around the lower margin of the propodeum; petiole and dorsal surface of the gaster very dark brown, the latter with faintly indicated pale transverse bands, the best defined of which is on apical half of tergite (2 + 3); ventral surface of the gaster pale reddish-yellow with a brownish tint. Scape and pedicel pale brownish-yellow; flagellum broken, brown but with at least

9 yellow apical segments. Palpi whitish-yellow. Hind coxae and trochanters pale brownish-yellow; front and middle coxae merely yellowish; hind femora pale brownish-yellow with a reddish tinge above and with a dark brown patch on each side just distal to middle; hind tibiae evenly honey-yellow throughout; hind tarsi reddish. Wings rather markedly brownish; stigma yellow on about basal ⅓ and at extreme apex.

Head strongly transverse, much narrower behind the eyes than across them, like that of *colophon* in a dorsal view (cf. fig. 68). Face with coarse more or less transverse wrinkly rugosity, which is very slightly weaker along the middle line. Frons and vertex with very strong, coarse, transverse wrinkly striation. Antenna broken but with at least 45 segments; flagellum clothed with conspicuous bristly hairs which on the more basal segments are almost, and on outer side fully, as long as the width of the segments; flagellum 1 a trifle longer than scape plus pedicel, 9 : 8. Ocelli arranged in a triangle with base clearly longer than sides.

Thorax: Pronotal keel narrowly fused in the middle with the posterior margin of the pronotum; lateral depression fairly well defined, with strong transverse ribs. Mesonotum falling rather abruptly to the pronotum, its hairs sparse, outstanding, its surface covered with very strong shining rugae which on the lateral lobes leave free a very narrow elevated linear area which is shining and has only the merest trace of ground sculpture; on the middle lobe there are faint traces of a linear zone of fine ground sculpture on each side of the middle line; posterior ridges strong, wavy, nearly parallel. Scutellum flat, shining, with a few extremely shallow, fovea-like depressions around its edges; anterior depression without clearly defined costae but with a few strong ruga-like elevations of very irregular appearance. Propodeum: basal carina a little less than half as long as its very wrinkly forks; areola separated from the area petiolaris by a ridge of rather unstable appearance; dorsal areas everywhere with very strong rugose-reticulation; rather prominent posterior protuberances present. Disc of the mesopleura smooth, shining; furrow foveate. Legs: hind coxa with a sharp dentiform projection; hind femur moderately stout, of ordinary form; hind tibia somewhat stout, but not swollen at base, the hairs of its upper surface long, almost erect, nearly twice as long as its middle width; apical lobe with 3 spines; hind tarsus 1 twice as long as 2; 3 ⅔ of 5. Wings: recurrens received into the 2nd cubital cell at a distance from the 1st intercubitus equal to one-half its own length; nervus parallelus not interstitial.

Abdomen: Petiole about 1½ times as long as the propodeum, longitudinally rugose-reticulate, but towards the apex, as is usual, regularly striate. Ovipositor sheaths a trifle longer than the gaster.

Length: 6·3 mm. without ovipositor.

BORNEO: Kuching, unique type ♀ (*J. Hewett*, ex Cameron Coll.).

Type in British Museum (Natural History).

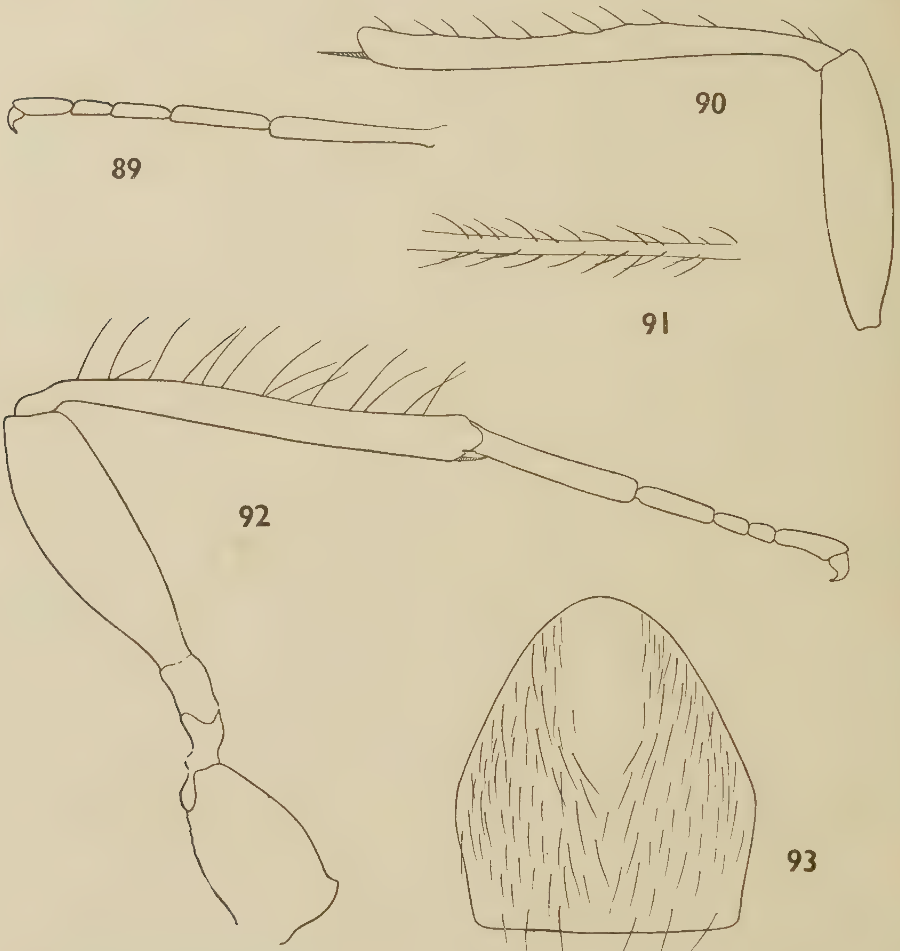
This species is very closely allied to *colophon* sp. n., differing from it chiefly in being larger and having a shorter ovipositor and more rugosity on the dorsal areas of the propodeum. In spite of these differences it may be only a geographical race of *colophon*, but if that were so, it would be difficult to account for the single typical *colophon* which I record from Palawan.

Spathius epaphus sp. n.

This species is very closely related to *colophon* and the characters given in the key pretty well sum up the chief differences between them. A detailed comparison with *colophon* follows:—

♀. Pale parts of the legs slightly deeper in tint, honey-brown rather than honey-yellow. Head much more strongly narrowed behind the eyes (fig. 67). Antenna with 44–47 segments (3 ♀♀); hairs of the flagellum slightly shorter and less outstanding.

Posterior carinae of the mesonotum apparently so broken and irregular as to be completely lost in the surrounding sculpture. Scutellum sometimes with shallow fovea-like impressions on the disc. Basal carina of the propodeum about $\frac{1}{2}$ to $\frac{2}{3}$ as long as its forks. Posterior margin of the mesopleura with its foveae prolonged to form obsolescent sulcation which reaches roughly a line drawn parallel to the posterior margin itself and touching the apex of the central fovea. Projection of hind coxa feeble and blunt; hind tibia slightly thicker, its upper edge less obviously serrate; hind tarsus 1 a little less than twice 2. Wings (fig. 103).



Figs. 89–93.—89 & 90. *Spathius merope* sp. n., hind leg, ♀; 91. *S. naupactus* sp. n., section of ovipositor; 92. *S. iphitus* sp. n., hind leg, ♀; 93. *S. dolopes* sp. n., mesonotum.

Ovipositor a little shorter, its sheaths about as long as the abdomen plus the propodeum.

Borneo: Sandakan, 4 ♀♀, one the type (*Baker*). Philippines: Mindanao, Iligan, 1 ♀ (*Baker*); Butuan, 3 ♀♀ (*Baker*).

Type in U.S. National Museum.

Except that the Philippine specimens are a little smaller and paler in colour than the Bornean material, there is nothing, so far as I can see, to suggest that they might be a geographical race of the nominotypical form.

Spathius gades sp. n.

♀. Deep red-brown, the thorax sometimes with a wine-red flush; head and gaster a little paler. Antennae brown, paler at base and with the apical 10–11 segments pa' yellow. Front and middle coxae yellowish; hind coxae reddish; all the femora reddish, sometimes yellowish at base; all the tibiae more or less pale reddish-yellow. Stigma of the fore-wing yellowish on about basal ⅓.

Head much narrower behind the eyes than across them (fig. 64). Face transversely rugose, becoming smooth along the middle line. Frons strongly, coarsely, transversely striate. Vertex coarsely transversely striate like the frons but the striation tends to be broken and confluent; the posterior declivous part of the vertex tends to be completely smooth. Antenna with 36–37 segments (2 ♀♀); hairs of the flagellum fully as long as the middle width of the segments, bristling and set at about 45 degrees.

Thorax: Pronotal keel widely separated from the posterior margin of the pronotum, well developed. Mesonotum sloping rather gradually to the pronotum (fig. 42); notaulices deep, wide, composed of a series of shining transverse foveae; in larger examples the notaulices tend to be submargined on each side so that the middle lobe appears raised and sharply delimited on each side; by far the greater surface of the middle lobe has a fine ground sculpture, with feeble shining rugulosities irrupting along the middle line and against the notaulices; lateral lobes with a wide longitudinal band, sometimes triangularly dilated posteriorly, of fine ground sculpture; posterior carinae clearly defined but sometimes a little broken. Scutellum with feeble scaly-reticulation, which is virtually absent in small specimens. Basal carina of the propodeum ⅔ to nearly equal the length of its forks; dorsal areas shining, with occasional rugosities along the margins but without definite surface sculpture; posterior protuberances very prominent (fig. 30). Disc of the mesopleura more or less smooth, shining. Hind coxa with a sharp projection at base; hairs of the upper surface of the hind tibia about 1½ times its middle width; apical lobe virtually without spines but in some examples one or two fine spines can be seen near the shorter spur; hind tarsus 1 twice 2; 3 is ⅔ of 5; hairs of the upper surface of the apical tarsal segment of all legs, except around the apical rim, short and even (fig. 83). Recurrens received into the 2nd cubital cell at a distance from the 1st intercubitus equal to nearly half its own length; 2nd abscissa of the radius as long as the 1st transverse cubitus; general facies of wings as in *epaphus* (cf. fig. 103).

Abdomen: Petiole nearly 1⅔ times as long as the propodeum, with a few obsolescent longitudinal carinae and with vague rugosities between them. Ovipositor sheaths about ⅔ as long as the whole abdomen.

Length: 4–4·2 mm. without ovipositor.

PHILIPPINES: Los Baños, 3 ♀♀ (*Baker*); Luzon, Mt. Makiling, 3 ♀♀ (*Baker*); Mindanao, Butuan, 3 ♀♀, one the type (*Baker*); Mt. Banahao, 1 ♀ (*Baker*). BORNEO: Sandakan, 2 ♀♀ (*Baker*), (hairs of the upper surface of the hind tibia almost twice as long as its middle width).

Type in U.S. National Museum.

It is possible that the females from Sandakan represent a subspecies, but until more material can be studied I do not think the point can be satisfactorily settled.

Spathius gades is very closely related to *colophon* and *epaphus* but differs from both by the shorter ovipositor. It is a difficult species of rather doubtful limits.

Spathius lynceus sp. n.

This species is very closely allied to *gades* and for a long time I could not satisfy myself that the two forms were specifically distinct until I found that a reliable means of separation exists in the size of the apical tarsal segment; *lynceus* may be compared with *gades* as follows :—

♀. Dark yellowish-brown rather than reddish-brown. Wings decidedly infumated. Larger and stouter in build. Frons and vertex with smooth, strong striation which is concentric about the ocelli. Antenna with 39 segments (paratype), the apical 12 pale yellow. Propodeum less shining, less sharply areated and with more rugose-reticulation within the dorsal areas; basal carina much shorter than its forks; posterior protuberances less prominent. Apical tarsal segment of all legs larger and stouter in proportion to the other tarsal segments, the hairs of its upper surface somewhat uneven, its claws larger and more hooked (fig. 84).

Length : 5 mm. without ovipositor.

PHILIPPINES : Mindanao, Davao, 8–13.vi.1910, 1 ♀, the type (*Micholitz*); Butuan, 1 ♀ (*Baker*).

Type in British Museum (Natural History).

Spathius cyclops sp. n.

♀. Virtually black to the naked eye; there is a faint reddish suffusion along the inner eye-margin and on the gaster there are 2 faint transverse dull reddish bands. Palpi pale yellow. The 4–5 flagellar segments proximal to the apical 7 segments dull yellowish; flagellum otherwise evenly brown. Hind coxae almost black, the other 2 pairs brown; all the femora and tibiae dark brown; front and middle tibiae faintly paler at apex. Wings rather strongly infumated; stigma faintly pale at base.

Head considerably narrower behind the eyes than across them. Face coarsely transversely rugose. Frons and vertex very coarsely rugose; towards the temples the rugosities tend to form themselves into transverse rugae. Cheeks with similar coarse sculpture but the rugosities tend to run parallel with the occipital margin. Antenna with 41 segments; flagellum 1 as long as scape plus pedicel, its hairs short and at least on the more basal segments not longer than the width of the segments.

Thorax : Pronotal keel feeble but free; lateral area moderately well defined, shining and with smooth ridges. Mesonotum with coarse sculpture almost everywhere; on the middle lobe there is a narrow medial band of raised rugosities and on each side of it a narrow line of fine surface sculpture; the lateral lobes have a narrow longitudinal band of fine surface sculpture. Scutellum everywhere with rather feeble rugosities. Propodeum : areation on dorsal surface ill defined; basal carina a little shorter than its forks; dorsal areas not delimited postero-laterally, their surface shining and with some kind of smooth rugosity almost everywhere; hardly a trace of posterior protuberances. Mesopleura smooth within a small median area but otherwise with some kind of rugosity almost everywhere. Hind coxa virtually simple beneath; at most a trace of a blunt angulation here; hairs of the upper surface of the hind tibia set at 45 degrees, about as long as its middle width; apical lobe without spines; hind tarsus 1 twice 2; 3 about $\frac{2}{3}$ as long as 5. Recurrens received into the 2nd cubital cell at a distance from the 1st intercubitus equal to a little less than half its own length.

Abdomen : Petiole of normal length, $1\frac{1}{2}$ times as long as the propoedum, its surface very shining; on the apical constricted part the surface is quite smooth; the striation of the apical dilatation is much reduced and weak. Tergites 5–7 with a faint trace of extremely fine punctation, relatively most extensive on tergite 7; epipleura of tergites 4–7 also with faint traces of similar punctation. Ovipositor sheaths as long as the gaster.

Length : about 6·5 mm. without ovipositor.

PHILIPPINES : Luzon, Mt. Makiling, 1 ♀ (*Baker*).

Type in U.S. National Museum.

This is a very distinctive-looking species, immediately distinguishable from its allies in the subgroup of *colophon* (*colophon*, *epaphus*, *gades* and *lynceus*) on colour alone. From all *Spathius* with smooth tergite (2 + 3), it differs in having strongly rugose cheeks.

Spathius aphareus sp. n.

♀. Head, mesonotum, scutellum, pronotum and upper part of the mesopleura more or less rust-red; propodeum, metapleura, petiole and to a less extent the lower part of the mesopleura blackish, but sometimes with a dull reddish flush; gaster varying from red-brown to pitchy but always paler than the petiole. Apical 11–12 segments of the flagellum and the palpi pale yellow. Hind coxae and sometimes the middle coxae suffused with reddish-brown; hind femora honey-yellow at base; hind tibiae evenly honey-yellow throughout. Wing slightly smoky; stigma hardly pale at base. The distribution of light and dark areas on the thorax is variable; generally speaking, it could be said that the thorax is mostly red with a darkened propodeal region.

Head much narrower behind the eyes than across them and strongly narrowed towards the occipital margin (fig. 63). Face rather smoothly transversely striate, tending to be smooth along the middle line where it shows the usual elevation. Frons and vertex coarsely rugose; posterior declivous part of the vertex, more especially towards the temples, with a series of longitudinal ridges (not regular nor of equal definition) which branch off from the occipital margin and anteriorly merge into the rugose sculpture of the dorsal part of the vertex. Cheeks smooth. Antenna with 31–33 segments (2 ♀♀, Mt. Makiling); 38 segments (1 ♀, Dapitan); flagellum 1 slightly longer than scape plus pedicel, 13 : 11; hairs of the flagellum bristling, the longest of them about twice the width of the segments. Base of the ocellar triangle very slightly longer than its sides. Eyes large, nearly 3 times the length of the malar space, 8 : 3.

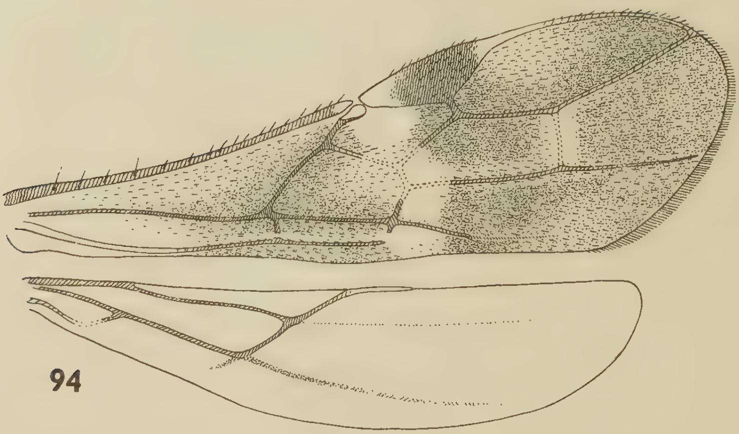
Thorax: Pronotal keel free, but only moderately developed; lateral area clearly defined, crossed by smooth ridges. Mesonotum with sparse, semi-erect hairs; notaulices deep, rather evenly transversely costate; middle lobe rather sharply delimited, its surface somewhat glistening, finely rugulose all over; lateral lobes with a fine surface sculpture over most of their surface; the area occupied by this fine sculpture is by no means linear. Scutellum flat, shining and with feeble scaly-reticulation; sometimes with traces of transverse rugosity. Costae of the mesopleural furrow tending to spread upwards on to the disc. Propodeum very shining, its areation on the whole clearly defined; basal carina about as long as its forks; ridge separating the areola from the area petiolaris not prominent, though completely developed; dorsal areas very shining and with hardly a trace of surface sculpture; posterior protuberances hardly prominent as, for example, in *gades* sp. n. (cf. fig. 30). Legs: hind coxa with a well-defined projection at base; hairs of the upper surface of the hind tibia semi-erect, a little longer than its middle width and set at about 45 degrees (fig. 77); apical lobe without spines; hind tarsus 1 slightly less than twice 2, 9 : 5; 3 hardly shorter than 5. Recurrens received into the 2nd cubital cell at a distance from the 1st intercubitus equal to nearly half its own length.

Abdomen: Petiole a little less than twice as long as the propodeum, decidedly slender, with obsolescent ridges and the intervals between them vaguely rugose. Ovipositor sheaths clearly a little longer than the gaster, about 11 : 9.

Length: 3·5–4 mm. without ovipositor.

PHILIPPINES: Luzon, Mt. Makiling, 6 ♀♀, one the type (*Baker*). Mindanao, Zamboanga, 2 ♀♀ (*Baker*); Dapitan, 1 ♀ (*Baker*).

Type in U.S. National Museum.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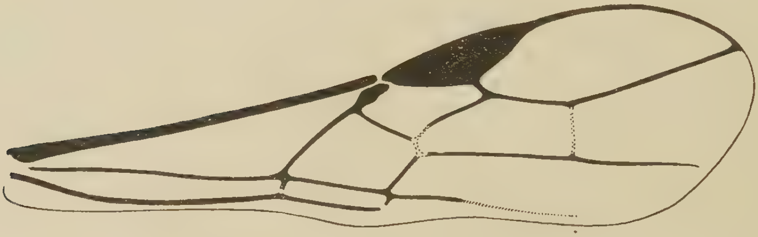
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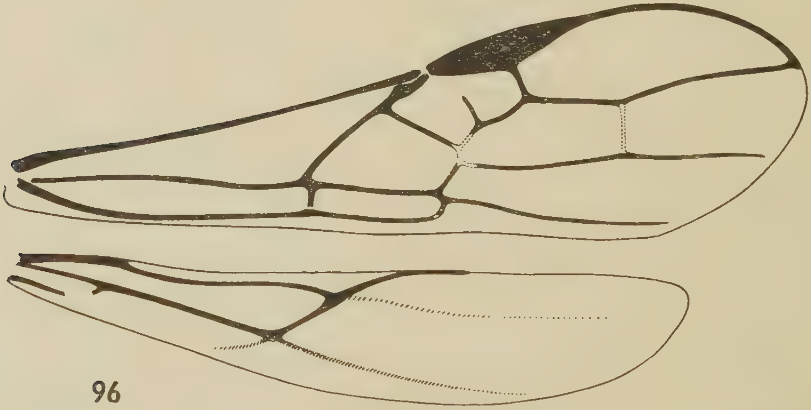
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Figs. 94–96.—Wings of *Spathius* :—94. *Spathius bion* sp. n., ♀; 95. *S. aphareus* sp. n., ♀; 96. *S. capaneus* sp. n., ♀.

Spathius anytus sp. n.

Extremely like *aphareus*, with which species it may be compared as follows :—

♀. Build more slender. Apical 8 flagellar segments whitish-yellow. Hind femora evenly reddish-yellow throughout.

Posterior declivous part of the vertex without defined longitudinal ridges; the surface here shining and with feeble, patchy rugosity, more or less scaly-reticulation. Antenna with 30–31 segments (2 ♀♀); hairs of the flagellum slightly longer and more erect (fig. 98). Mesonotum with rather more raised rugosity; that area, in *aphareus*, occupied by fine ground sculpture less extensive, almost parallel-sided. Propodeum a little longer, its areation less distinct; basal carina longer, about 1½ times as long as its forks; ridge separating the areola from the area petiolaris more sharply defined, prominent and, in a lateral view of the propodeum, showing as a sharp tooth; dorsal areas more elongate and with coarse rugosity over their entire surface; this is mostly in the form of longitudinal wrinkles. Hind coxa without a trace of a projection; hairs of the upper surface of the hind tibia more erect, sparser and fully twice as long as its middle width, inclined at about 60 degrees (fig. 76). Ovipositor sheaths shorter, about as long as the gaster.

PHILIPPINES: Luzon, Mt. Makiling, 2 ♀♀, one the type (*Baker*).
Type in U.S. National Museum.

Spathius dolon sp. n.

♀. Blackish to the naked eye; head reddish, slightly paler around the eye and on the cheeks; mesonotum blackish, but very faintly reddish along the course of the notaulices and within the rugose posterior depression; rest of the thorax blackish with faint reddish suffusions mostly on pronotum and mesopleura beneath the wing insertions; gaster pitchy brown. Antennae broken, dark brown but with three yellow segments at apex. Palpi whitish-yellow. Front and middle coxae pale yellow; hind coxae and hind femora, except the latter on basal $\frac{1}{5}$, and the hind tarsi dark brown; hind tibiae pale honey-brown. Fore-wings rather strongly smoky; stigma hardly paler at base.

Head strongly transverse and strongly narrowed towards the occipital margin; also much narrower behind the eyes than across them (fig. 61). Face shining, with fine transverse, somewhat broken striation except along the weak medial elevation. Frons finely striate. Vertex everywhere with fine striation which runs from the ocellar region more or less in the direction of the temples and is thus almost longitudinal instead of transverse as is usually the case; near the ocelli, this striation is somewhat broken and confluent. Eyes unusually large, their longer axis 3 times as long as the malar space. Base of the ocellar triangle very slightly longer than its sides. Antenna, broken but with 27 segments existing; the slightly doubtful specimen mentioned at end has 8 yellow apical segments so that it would be reasonable to assume about 8 for the type, in which case the antenna would be about 33-segmented; flagellum 1 a trifle longer than scape plus pedicel, 6 : 5; hairs of the flagellum bristly, clearly longer than the width of the segments on more basal segments.

Thorax: Pronotal keel fused with the posterior margin of the pronotum medially; lateral area moderately well defined. Mesonotum sloping rather abruptly to the pronotum, its hairs long and sparse; lobes glistening, their sculpture predominantly fine; posterior rugose area extensive; the rugosities tend to encroach on to the lateral lobes and almost reach the middle line; posterior carinae not sharply defined. Scutellum more or less flat, faintly scaly-reticulate. Basal carina of the propodeum about as long as its forks; dorsal areas shining, feebly and very vaguely rugose; ridge separating areola from the area petiolaris sharply defined; weak posterior protuberances present. Disc of the mesopleura shining, polished. Hind coxa with a dentiform projection at base; hind femur rather evenly narrowed to base; hairs of the upper surface of the hind tibia set at about 45 degrees and about 1½ times as long as its middle width; apical lobe without spines; hind tarsus 1 a trifle less than twice 2; 3 is ¾ of 5. Recurrens of the fore-wing received into the 2nd cubital cell at a distance from the 1st transverse cubitus equal to ⅓ its own length.

Abdomen: Petiole rather long, about twice the length of the propodeum, vaguely reticulate-striate but the striate element not at all conspicuous. Ovipositor sheaths a little longer than the gaster.

Length: 4 mm. without ovipositor.

Java: Tjibodas, 5–7000 ft., viii.1913, 1 ♀, the type (*Koningsberger*).

Type in British Museum (Natural History).

I also refer to this species a single female from Borneo, Sandakan (*Baker*), in which the head is slightly more transverse, the striation of the vertex sharper and more obviously longitudinal in direction, the lateral lobe of the mesonotum showing slightly greater encroachment of raised rugosity on both inner and outer side, basal carina of the propodeum $\frac{1}{3}$ the length of its forks and the mesopleura with the faintest indication of obsolescent rugosity; the antenna is 32-segmented with the apical 8 segments yellow. All these differences are slight and do not, I think, entitle the insect to subspecific rank, even if a series were available.

Spathius dolon is probably most closely related to *aphareus* and *anytus*, having the same delicate facies. The only character by which it differs from these two species seems to be the fusion of the pronotal keel with the posterior margin of the pronotum, but in any case the use of this feature as an indication of group affinities needs to be regarded with some caution. Specifically, *dolon* is essentially characterised by its rather large eyes and the sculpture of the vertex.

Spathius ninus sp. n.

Differs from *aphareus* as follows:—

♀. Very dark brown, almost black. Legs honey-brown with the hind coxae and hind femora towards apex a little infuscated. Wings evenly and rather strongly smoky; stigma not at all pale at base.

Face smooth along the middle; elsewhere dull, closely shagreened. Frons with traces of delicate striation. Vertex with very faint traces of broken transverse striation, the sculpture in places (especially towards occipital margin) resembling obsolescent scaly-reticulation. Antenna broken but with 22 segments, the apical 2 of which are almost yellow.

Pronotal keel very feebly developed, medially fused with the posterior margin of the pronotum. Lobes of the mesonotum everywhere with a fine sculpture of broken scaly-reticulation; posterior carinae short, even. Scutellum dull, evenly scaly-reticulate over most of their surface; ridge separating area petiolaris from areola short, strongly raised and in profile showing as a sharp tooth. Hind coxa roundly angled at base; hind femur slightly more gradually widened from base to apex; hind tarsus 1 considerably less than twice 2, 17 : 11; 3 fully as long as 5. Mesopleural furrow sharply delimited, rather feebly foveate; disc shining, with excessively faint traces of surface sculpture. Recurrens entering the 2nd cubital cell slightly nearer its base.

Petiole a little shorter, more smoothly carinate. Ovipositor sheaths not longer than the gaster.

Length: 3·3 mm. without ovipositor.

Borneo: Sarawak, Mt. Dulit, R. Koyan, 2500 ft., primary forest, 16.xi.1932, 1 ♀, the type (*B. M. Hobby & A. W. Moore*).

Type in British Museum (Natural History).

Spathius iphitus sp. n.

♀. This is a decidedly thick-set species. Head very dark brown, blackish to the naked eye; paler on face; thorax and petiole blackish; gaster chestnut brown. Antennae yellowish-brown at base, otherwise dark brown. Two basal segments of the maxillary and labial palpi darkened, otherwise whitish-yellow. All the coxae brownish but paler above; hind femora narrowly infuscated along each side but when seen from above appearing entirely deep yellow; all the tibiae pale honey-yellow; hind tarsi of a deeper yellow colour than their tibiae. Fore-wing faintly and evenly brownish; stigma pale, unicolorous, dingy yellowish.

Head very strongly transverse, short behind the rather large eyes, much narrower behind the eyes than across them and strongly narrowed towards the occipital margin (fig. 65). Face rather coarsely striate on each side of the middle line; medial elevation feeble and with faint scaly-reticulation. Frons very shining, with some obsolescent striation. Vertex almost smooth; at a magnification of ×60 there is a faint indication of transverse striation and the merest suggestion of ground sculpture. Base of the ocellar triangle very slightly longer than its sides. Antenna with 39 segments; flagellum 1 a little shorter than scape plus pedicel; hairs of the basal segments of the flagellum rather pale, those on at least the 6 basal segments not longer than the width of the segments.

Thorax: Pronotal keel medially widely fused with the posterior margin of the pronotum; lateral area clearly defined. Mesonotum falling virtually perpendicularly to the pronotum; hairs outstanding and very sparse; surface very strongly shining and with a vague ground sculpture predominating; this sculpture looks in places as if it had been rubbed off; posterior carinae poorly defined and with no rugae branching off from them on to the lateral lobes. Scutellum almost flat, shining, but with a dull ground sculpture on about posterior third. Propodeum: basal carina about ⅔ as long as its forks; dorsal areas with feeble ground sculpture on anterior half and rugose elsewhere; areola confluent with the area petiolaris, the area thus formed crossed by strong ridges of more or less equal development; rather prominent posterior protuberances present. Disc of the mesopleura shining and virtually smooth. Hind coxa with a blunt projection beneath at base; hind femur rather thick; hairs of the upper surface of the hind tibia long, about 2½ times as long as its middle width (fig. 92); apical lobe with a single inconspicuous spine; hind tarsus 1 a little more than twice 2, 7 : 3; 3 hardly more than half 5. Recurrens received into the 2nd cubital cell at a distance from the 1st transverse cubitus equal to a little more than half its own length; nervus parallelus almost interstitial.

Abdomen: Petiole 1½ times as long as the propodeum, with longitudinal, somewhat confluent striation, the intervals rugulose. Extreme base of tergite (2 + 3) with the merest indication of striation; epipleura of this tergite closely, finely punctate, except for an impunctate line marking the fusion of its two component parts. Tergites 4–7 finely, closely punctate on about basal half; the punctate area is partly obscured owing to retraction of the segments; the epipleura of these tergites also punctate. Ovipositor sheaths about as long as the whole abdomen.

Length: 4·8 mm. without ovipositor.

MALAYA: Singapore, 1 ♀ (*Baker*).

Type in U.S. National Museum.

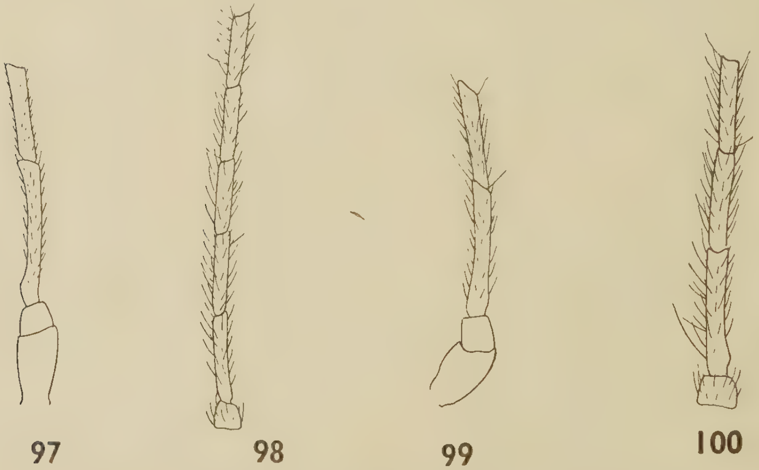
This very distinct species appears to be isolated. It is chiefly characterised by the shape of the head, the very shining mesonotum, the punctation of the gaster and the pale unicolorous stigma of the fore-wing; this last is a most unusual feature in *Spathius*.

Spathius prodicus sp. n.

♀. Yellowish-brown; the head a little more yellowish in tint than the thorax; gaster in type (the largest specimen) with faint yellow transverse bands. Apical 9 segments of the flagellum pale yellow. Legs pale yellowish-brown with the hind coxae and hind femora very slightly embrowned. Basal ⅓ of the stigma pale.

Head considerably narrower behind the eyes than across them, much as in *gades* (cf. fig. 64) but the eyes slightly less bulging. Face rather feebly rugose; in the type, with a broad smooth medial elevation on each side of which is some feeble transverse sulcation with indication of ground sculpture; in the two paratypes, on the other hand, the face is more shining and smoother, the sulcation being almost obliterated. Vertex with some very feeble transverse striation which is weaker in the two paratypes than in the type. Antenna with 32 segments (one paratype); flagellum 1 a little longer than scape plus pedicel, 13 : 11; hairs of the flagellum clothed with bristling hairs, set at about 45 degrees and about as long as width of the segments. Base of the ocellar triangle clearly longer than its sides.

Thorax: Pronotal keel well developed medially but very weak at the sides, widely separated from the posterior margin of the pronotum and in a lateral view of the thorax, lying below it; lateral area clearly defined. Mesonotum falling somewhat gradually to the pronotum; in a lateral view, forming an even curve from base to apex (fig. 44); its hairs very sparse, almost erect; lobes in greater part with a somewhat coarse glistening ground sculpture; lateral lobes with a dull longitudinal linear band of fine sculpture which is finer than the adjacent surface sculpture; notaulices rather deep and rather sharply marked off from the middle lobe, being almost carinate along their inner margin. Scutellum flat, dull, scaly-reticulate. Propodeum: basal carina about as long as its forks; these rather ill defined; dorsal areas over most of their surface scaly-reticulate, somewhat dull; areola separated from the area petiolaris by a distinct carina. Mesopleura with some kind of sculpture almost everywhere; the disc is covered with obsolescent carinae which are an upward prolongation of the costae of the furrow; it also has an obsolescent surface sculpture similar to that of the mesonotum; the upper part of the mesopleura is strongly sub-longitudinally rugose, the surface, including that of the raised rugosities, covered with the prevailing surface sculpture. Hind coxa with a dentiform projection at base; hind tibia rather stout, the hairs of its upper surface about half as long as its middle width and of unequal length when the tibia is seen in profile; apical lobe with a single spine near the shorter spur; hind tarsus 1 twice 2; 3 is $\frac{2}{3}$ of 5; basal segment of the middle tarsus nearly 4 times as long as wide. Recurrens received into the 2nd cubital cell at a distance from the 1st transverse cubitus equal to about $\frac{1}{3}$ its own length.



FIGS. 97–100.—Basal part of antenna of :—97. *Spathius sabronensis* sp. n., ♀; 98. *S. anytus* sp. n., ♀; 99. *S. neleus* sp. n., ♀; 100. *S. dolopes* sp. n., ♀.

Abdomen: Petiole less than twice as long as the propodeum, somewhat dull, scaly-reticulate and with a few obsolescent longitudinal ridges. Ovipositor sheaths slightly longer than the gaster.

Length: 3·5–4 mm. without ovipositor.

PHILIPPINES : Mindanao, Butuan, 3 ♀♀, one the type (*Baker*).

Type in U.S. National Museum.

This species is largely characterised by the surface sculpture which covers most of the thorax and the very feebly sculptured vertex. It is rather closely related to *gades* sp. n.

Spathius erymanthus sp. n.

♀. Fulvous red to the naked eye; the thorax and the petiole with a purplish tint; tergite (2 + 3) with a large and conspicuous brown blotch. Antenna broken but with no indication of yellow segments in the type, which still has 35 segments. Hind coxae pale yellowish-brown; hind femora slightly darker than the hind coxae and with a trace of infuscation above towards apex; hind tibiae brown, honey-yellow on basal $\frac{2}{5}$. Stigma of the fore-wing yellow on nearly basal half.

Head only very slightly narrower behind the eyes than across them, 32 : 35, and only feebly narrowed towards the occipital margin. Face broadly smooth along the middle line; otherwise with fine transverse broken striation. Frons with a patch of striation on each side of the middle line; broadly smooth along the eye-margin. Vertex completely smooth. Antenna with at least 36 segments; flagellum 1 as long as scape plus pedicel, its hairs short, almost adpressed and a little shorter than the width of the segments. Ocelli in an equilateral triangle. Eyes with metallic blue-green reflections.

Thorax : Pronotal keel well defined, free; lateral area well defined, smooth, shining, except for fine transverse ridges. Mesonotum sloping rather gradually to the pronotum; middle lobe of the mesonotum with a glistening scaly-reticulation; lateral lobes with a few feeble rugae extending outwards from the notaulices; area of the lateral lobes occupied by ground sculpture large and its outline blurred; posterior carinae fairly well defined. Scutellum almost flat, shining and with faint indications of rugosity. Propodeum shining, and with much broken reticulation everywhere; basal carina present but very irregular, its forks broken up to form part of the general reticulation; areola hence not defined; area petiolaris completely delimited. Mesopleura shining, with only a small medial patch which is virtually smooth; elsewhere the disc is scored by obsolescent ridges and rugosities which form an upward prolongation of the costae of the furrow; there is also some indication of feeble surface sculpture. Hind coxa with hardly a trace of a projection; hairs of the upper surface of the hind tibia about $1\frac{1}{2}$ times as long as its middle width; hind tarsus 1 twice 2; 3 as long as 5. Recurrens of the fore-wing received into the 2nd cubital cell at a distance from the 1st transverse cubitus equal to nearly half its own length; short spurious vein arising from the lower side of the mediellan cell at apex widely antefurcal.

Abdomen : Petiole rather long, nearly twice as long as the propodeum, 29 : 15 (fig. 35), feebly shining, covered everywhere with a glistening scaly-reticulation; longitudinal elements in the sculpture, except at the apical dilatation, feeble and overlaid with the prevailing ground sculpture. Ovipositor sheaths almost $1\frac{1}{2}$ times as long as the whole abdomen.

Length : 4·5 mm. without ovipositor.

PHILIPPINES : Mindanao, Surigao, 2 ♀♀, one the type (*Baker*).

Type in U.S. National Museum.

A single female from Palawan, Puerto Princesa, slightly smaller than typical *erymanthus*, probably represents a race of it but I hesitate to propose a name for it; it differs from the named form as follows :—hind tibia pale only at extreme base, that is, on the narrowed basal portion, otherwise brown throughout; tergite (2 + 3) without a dark blotch.

Spathius erymanthus, though by no means a striking-looking species, appears to be somewhat isolated. What I take to be its essentially specific features seem to be provided by the abdomen, namely, rather long petiole with its glistening microsculpture, long ovipositor and the dark blotch on tergite (2 + 3).

Spathius bion sp. n.

This is another isolated species of doubtful affinities.

♀. Upper parts of the head pale yellow or testaceous yellow, the face pale reddish-brown; the body otherwise pale reddish-brown with a slight yellowish suffusion in the middle of the gaster in two of the females (including the type); in the 3rd female the ground colour is darker, the insect appearing quite dark to the naked eye; in this female the mesonotum is paler in the middle and the pale yellow head contrasts more sharply with the brown thorax than in the other two females; in all three individuals the ventral surface of the gaster is yellowish, though least bright in the dark female. Antennae pale brown to dark brown but not paler at base and with the apical 8–9 segments bright yellow. Front and middle coxae yellowish; hind coxae and hind femora brown throughout; hind tibiae brown on rather more than apical half, otherwise whitish-yellow; hind tarsi yellowish. Fore-wing not evenly tinted, but clearly though not sharply fasciated (fig. 94). Palpi whitish-yellow throughout.

Head strongly transverse, much narrower behind the eyes than across them (fig. 25). Face shining, with broken transverse striation, strongly narrowed towards the mouth (fig. 27). Frons transversely striate. Vertex in the type with very weak obsolescent transverse striate-reticulation, most in evidence behind the ocelli, the vertex elsewhere being almost smooth; one of the other two females has the vertex much more strongly sculptured; the 3rd female (dark ex.) still more finely, the vertex being almost smooth. Antenna unusually short and rather thick, 27–28-segmented; flagellum clothed with stiff, bristling hairs which are about as long as the segments are wide; flagellum 1 as long as, or a trifle longer than, scape plus pedicel, but considerably longer than f. 2.

Thorax: Pronotal keel hardly developed and very difficult to make out; in the type and the darkest female it appears to be more or less contiguous with the posterior margin of the pronotum, in the 3rd female it is narrowly fused in the middle with it; lateral area moderately well defined. Mesonotum falling almost perpendicularly to the pronotum, predominantly rugose-reticulate everywhere; the area on the lateral lobes occupied by ground sculpture is small; on each side of the middle line of the medial lobe there is an indistinct band of fine ground sculpture; hairs sparse and erect. Scutellum feebly convex, smooth, shining. Propodeum: arrangement of the carinae apparently very variable; in the type, the basal carina is as long as its forks; in the other two females it is about $\frac{1}{5}$ as long; dorsal areas shining and with somewhat obsolescent rugosity; prominent posterior protuberances present; in profile these show as sharp teeth; ridge separating the areola from the area petiolaris only weakly emphasised. Disc of the mesopleura not extensively smooth, except in the darkest female; furrow wide, ill defined in the type; still more so in the intermediately coloured female and less so in the darkest female; strongly and very irregularly transversely striate, the striation tending to spread upwards in the direction of the posterior fovea and ventralwards on to the mesosternum. Hind coxa obscured; hind femur moderately thick and fairly evenly narrowed to base; hairs of the upper surface of the hind tibia rather numerous, about twice as long as its middle width; apical lobe without spines; hind tarsus 1 a trifle less than twice 2, 17 : 9; 3 is $\frac{2}{3}$ of 5. Recurrens received into the 2nd cubital cell at a distance from the 1st transverse cubitus equal to from $\frac{2}{3}$ to $\frac{3}{4}$ its own length; nervus parallelus exactly interstitial (fig. 94).

Abdomen: Petiole about $1\frac{1}{2}$ times as long as the propodeum, in profile rather strongly arched at base (fig. 32); the spiracles are prominent, especially in the darkest female;

in the middle, the petiole tends to be merely vaguely reticulated with the longitudinal element almost obliterated. Ovipositor very short, its sheaths a little shorter than the gaster.

Length: about 3·8 mm. without ovipositor.

PHILIPPINES: Luzon, Mt. Makiling, 3 ♀♀, one the type (*Baker*).

Type in U.S. National Museum.

This is an interesting little species and not to be confused with any other *Spathius* described in this work. I know no species to which it appears to be at all closely related. Highly characteristic of it are (1) the short antennae, (2) the pale head, (3) the strong propodeal teeth and (4) the fasciation of the fore-wings together with their venation, *i.e.*, exactly interstitial nervus parallelus. The great variability in the length of the basal carina of the propodeum seems to be unusual, and in the case of the female, where it is longest, this may be due to individual freakishness.

Spathius tahitiensis sp. n.

♀. Medium brown, the gaster a little darker than the petiole. Palpi whitish-yellow. Antennae yellowish. Hind coxae and hind femora brown throughout; hind tibiae brown, but colourless on about basal third. Stigma pale on about basal third.

Head as wide behind the eyes as across them. Face dull, transversely rugulose. Vertex closely and, on the whole, smoothly striate but immediately behind and to sides of ocelli the intervals are faintly rugulose. Frons covered with fine rugulosity mixed with striation. Antenna with 31–34 segments (2 ♀♀); flagellum 1 a trifle shorter than scape plus pedicel, 9 : 10. Ocelli almost in an equilateral triangle.

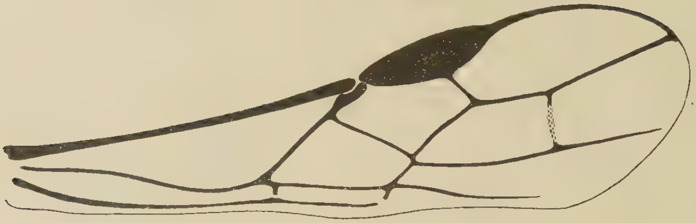
Thorax: Pronotal keel very indistinct, apparently fused medially with the posterior margin of the pronotum; lateral area moderately well defined, crossed by a few strong ridges on a smooth surface. Mesonotum falling perpendicularly to the pronotum; lobes almost everywhere very finely sculptured; posterior carinae moderately well defined; notaulices costate; hairs very sparse, outstanding. Scutellum evenly and quite strongly convex, shining and with obsolescent scaly-reticulation, more distinct posteriorly. Post-scutellum in profile with a sharp dentiform projection. Propodeum of very characteristic appearance, its surface *everywhere*, as well as that of the metapleura, covered with wide-meshed irregular reticulation; areola in the smaller female, the type, just indicated but very indistinctly; in the larger female, completely undefined; dorsal areas completely undelimited, even the lateral bounding carinae being wanting; sharp, dentiform protuberances present. Disc of the mesopleura nowhere completely smooth, but right in the middle nearly so. Hind coxa evenly rounded beneath at base; hind tibia somewhat thick, a little swollen on basal half; hairs of its upper surface about as long as its middle width; apical lobe with 5 spines; hind tarsus 1 twice 2; 3 shorter than 5, 5 : 8. Wings (fig. 101); medius rather strongly sinuate; nervus parallelus exactly interstitial.

Abdomen: Petiole 1½ times as long as the propodeum, striate-reticulate on basal half but becoming smoothly striate towards the apical dilatation; in profile strongly elbowed at base. Gaster smooth and shining; in the larger female, the paratype, there is the merest trace of striation at extreme base, visible at ×60; tergite (2 + 3) without a trace of a lateral margin. Ovipositor sheaths a little shorter than the gaster plus petiole.

Length: 3 mm., type ♀; 4 mm., paratype, without ovipositor.

SOCIETY Is.: Tahiti, 1 ♀, the type, obtained at Honolulu, Hawaiian Is. from coconut received from Tahiti; 1 ♀, same data, except from coconut from American Samoa.

Type in U.S. National Museum.



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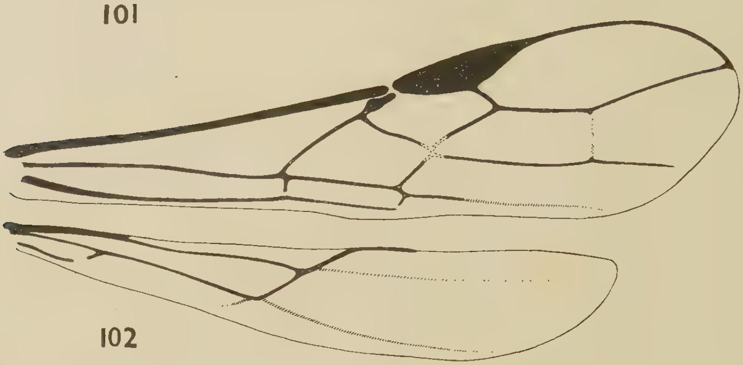

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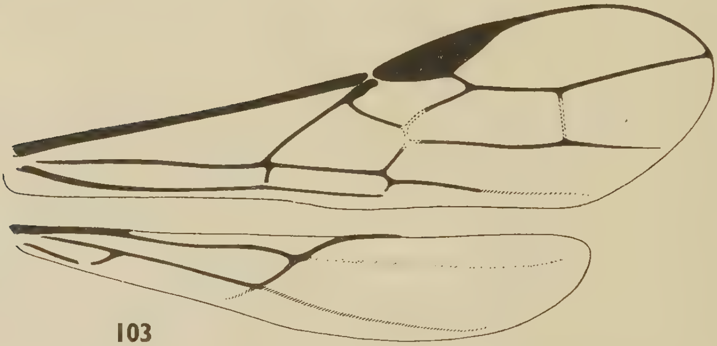

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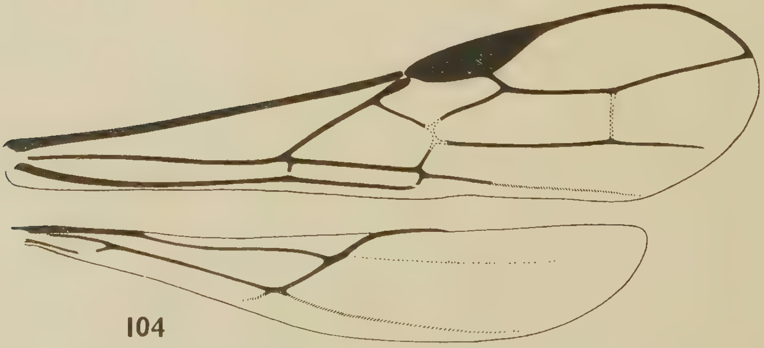

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Figs. 101–104.—Wings of *Spathius*:—101. *Spathius tahitiensis* sp. n., ♀; 102. *S. dolopes* sp. n., ♀; 103. *S. epaphus* sp. n., ♀; 104. *S. daedalus* sp. n., ♀.

I have drawn up the colour description from the type; the larger female is quite strikingly coloured by comparison with it but I cannot help thinking that the difference in colour may be due to discoloration; the head and thorax are markedly reddish, almost brick-red; the gaster is yellowish above to the naked eye, faintly banded with brown; the ventral surface is entirely brownish; the hind and middle femora are reddish-yellow streaked with brown along the sides.

This species appears to have no close allies and probably belongs to a group of species not otherwise represented in this monograph. It is characterised essentially by the sculpture of the propodeum in combination with the simple hind coxae and the striate vertex. The deeply sinuate medius of the fore-wing is also a character of value.

Group of **cassidorus** sp. n.

Characters: Front and middle coxae whitish; hind coxae reddish or reddish-brown. Wings considerably smoky; the stigma not paler at base. Vertex sculptured. Pronotal keel either obliterated medially or here widely fused with the posterior margin of the pronotum. Hind coxa without a basal projection. Mesopleura and dorsal areas of the propodeum dull, covered all over with a characteristic sculpture of close even scaly-reticulation which overlies any raised sculpture that may be present. Gaster smooth and shining. Petiole very long and narrow.

NEW GUINEA; SOLOMONS. Two species.

Key to the species of the **cassidorus** group.—Females.

Hind trochanters predominantly reddish-brown; head much narrower behind the eyes than across them . . . . *cassidorus* sp. n.
Hind trochanters predominantly whitish; head only a little narrower behind the eyes than across them . . . . *cephisus* sp. n.

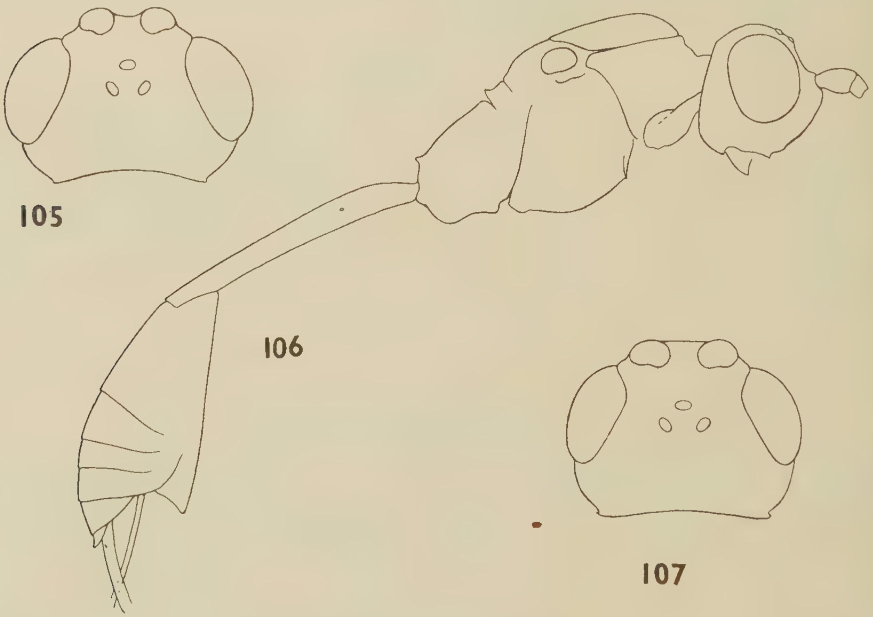
Spathius cassidorus sp. n. (fig. 106).

♀. Head dark brown, paler around the eye-margins and antennal insertions; thorax blackish but pronotum showing a faint reddish flush; petiole blackish but with a dull reddish flush in apical half; dorsal surface of the gaster dark brown, except for a sharply delimited transverse, ivory-white band just posterior to the apical margin of tergite (2 + 3); tergite 8 also ivory-white; ventral surface of the gaster, excluding the epipleura of tergites 6–8, more or less ivory-white except for sharply discrete encroachments of the brown colour on the epipleura of tergites (2 + 3) and 4. Antennae dull brownish, the flagellum without pale apical segments. Palpi whitish-yellow. Front and middle coxae whitish; hind coxae red-brown; front and middle femora marked with whitish at base; hind tibiae and tarsi brownish throughout. Wings rather dark, smoky, the stigma not at all paler at base.

Head strongly transverse, much narrower behind the eyes than across them, and markedly narrowed towards the occipital margin (fig. 105). Face shining and nearly smooth broadly along the middle; at the sides dull, with very feeble transverse rugulosities on a subgranular ground sculpture. Frons and vertex with feeble transverse rugulosities on a dull, closely scaly-reticulate (appearing granular) ground sculpture; the sculpture reaches the occipital margin and covers the temples. Ocelli arranged almost in an equilateral triangle. Eyes large, their longer axis 3 times the length of the malar space. Antenna with 36 segments;

flagellum 1 longer than scape plus pedicel, 4 : 3; hairs of the more basal segments of the flagellum inconspicuous, shorter than the width of the segments.

Thorax: Pronotal keel completely obliterated medially; lateral depression smooth, finely pubescent. Mesonotum falling fairly abruptly but not perpendicularly to the pronotum, its hairs sparse but almost recumbent, its sculpture on the whole fine; the notaulices are rather deep, especially on inner side; the margin thus formed is a continuation of the posterior ridges, which are clearly defined though short; a few feeble rugosities occur along the inner side of the lateral lobes and on the middle lobe posteriorly; the whole of the mesonotum, including the surface of the raised rugosities themselves, is covered with a glistening, scaly-reticulation. Scutellum almost flat, scaly-reticulate; its anterior depression in the form of two oblique, deep, narrow, smooth furrows, separated by a tiny costa. Postscutellum finely pubescent. Propodeum very characteristic in appearance, completely and very regularly areolated, the carinae thick and without a trace of lateral branches; the surface within the areas and, to a less extent, that of the dividing keels, covered with even scaly-reticulation; all the areas except the two dorsal ones are thickly pubescent; the ridge separating the areola from the area petiolaris is raised in the form of a lip and in profile shows as a sharp tooth. Surface of the mesopleura, including that of the feebly impressed furrow, dull, covered with the prevailing scaly-reticulation; raised rugosities are virtually absent within the subalar impression. Legs: hind coxa without a projection beneath; hind femur rather thick; hairs of the upper surface of the hind tibia very short, shorter than the middle width of the tibia but a little longer than the hairs on the lower side; apical lobe of the hind tibia with 1–2 spines; fringe 2–3; hind tarsus 1 very slightly more than twice 2; 3 two-thirds of 5. Wings: 1st abscissa of the radius very short, forming a straight line with the 2nd; recurrens received into the 2nd cubital cell at a distance from the 1st intercubitus equal to about $\frac{2}{5}$ its own (rec.) length; nervus parallelus exactly interstitial.



FIGS. 105–107.—105. *Spathius cassidorus* sp. n., head, dorsal; 106. *S. cassidorus*, body, lateral; 107. *S. cephisus* sp. n., head, dorsal.

Abdomen: Petiole long, narrow, not elbowed at base, twice as long as the propodeum (fig. 106), covered all over with the prevailing scaly-reticulation and, except towards the apical dilatation, with only extremely feeble longitudinal elements. Ovipositor sheaths about as long as the whole abdomen.

Length: 3·8 mm. without ovipositor.

DUTCH NEW GUINEA: Cyclops Mts., Sabron, 930 ft., 5.v.1936, 1 ♀ (*L. E. Cheesman*).

Type in British Museum (Natural History).

This is a most elegant little species. Apart from being related to the following species, its affinities are doubtful, though the shape of the head, large eyes, labiform ridge between areola and area petiolaris, unicolorous stigma and delicate facies, suggest a not distant relationship with those members of the heterogeneous *fasciatus* group which make up the *aphareus–anytus* complex, and especially with *anytus* sp. n., itself.

Characteristic about *Spathius cassidorus* sp. n. is the dominance, wherever sculpture occurs, of the scaly-reticulate ground sculpture; the appearance of the propodeum is particularly striking.

Spathius cephisus sp. n.

In spite of a rather striking difference in the shape of the head as seen from above, I am inclined to think that this species is fairly closely related to *cassidorus* sp. n., with which insect I compare it as follows:—

♀. Head of a paler brown colour, more uniform in tint, though the face is darker than the upper parts of the head; thorax, except the propodeum which is blackish, reddish-brown; petiole blackish, not paler towards the apex; dorsal surface of the gaster almost blackish with tergites 7–8 obscurely reddish-yellow; there is a suggestion of a pale band at apex of tergite (2 + 3) but it is much less clearly defined than in *cassidorus*; the ventral surface of the gaster is certainly paler at base but there is no sharp delimitation of pale and dark areas as in *cassidorus*. Scape and pedicel pale yellowish. Hind coxae brown without an obvious red tint; front and middle femora more extensively whitish; hind tibiae slightly paler with a faint suggestion of a transparent post-basal area.

Head as seen from above approaching a subcubical condition, hardly narrower behind the eyes than across them and not particularly narrowed towards the occipital margin (fig. 107). Face with shining, moderately strong, somewhat confluent, transverse striation, more feeble along the middle line; no trace of ground sculpture; hence the dull appearance characteristic of *cassidorus* missing. Frons and vertex with somewhat wrinkly, transverse, shining striation. Base of the ocellar triangle very slightly longer than its sides. Eyes smaller, less bulging but the relation between their long axis and the malar space the same. Antenna also with 36 segments; flagellum 1 a little longer in proportion to the combined length of scape plus pedicel, 13 : 9; hairs of the more basal segments of the flagellum still more inconspicuous, shorter.

Pronotal keel widely fused with the posterior margin of the pronotum; lateral depression crossed by a few strong carinae; a little thin pubescence present posteriorly. Mesonotum with much more raised sculpture, on the lateral lobes only a narrow linear band of ground sculpture left free; the middle lobe is covered all over with coarse, irregular, raised reticulations; no ground sculpture covers the raised rugosities. Anterior foveae of the scutellum much larger and wider and hence less oblique in appearance. Propodeum similar in shape and areolation but less characteristically sculptured; only a feeble, obsolescent ground sculpture is present but there is more raised rugosity in the form of short branches along the longitudinal carinae; these branches encroach on to the surface of the dorsal areas. Mesopleura with more raised rugosity, the subalar impression being filled with strong rugae; the furrow is costate throughout but the costae are not very close; the disc is scaly-reticulate. Hairs of the upper surface of the hind tibia a trifle longer but still not longer than the middle width of the tibia; apical lobe with 5 feeble spines. First abscissa of the radius of the fore-wing a little longer; recurrens received into the 2nd cubital cell at a distance from the 1st intercubitus equal to fully ½ its own length (of recurrens).

Petiole a little longer, about two and one-third times as long as the propodeum, its sculpture vague and indefinite but clearly without a dominant scaly-reticulate ground sculpture as in *cassidorus*.

British Solomons: Tulagi, 23.iii.1934, 1 ♀ (*R. E. Lever*).

Type in British Museum (Natural History).

In a genus like *Spathius*, where the shape of the head remains fairly constant within a group of closely allied species, the difference in the shape of the head in *cassidorus* and *cephisus* is rather bewildering, especially as the two species seem to emphasise their relationship by possessing an unusual combination of characters in common :—namely, sculpture and structure of the propodeum; details of hind leg structure, dark, evenly smoky wings and long, narrow petiole.

The affinity with the *aphareus–anytus* complex, which I suggested might exist in *cassidorus*, is of course much less apparent in *cephisus*, because of the shape of the head.

Group of **capys** sp. n.

Characters: Head markedly cubical, hardly narrower behind the eyes than across them. Vertex smooth. Propodeum without areation, long. Middle tarsus very short, the 1st segment not more than twice as long as wide; all the femora markedly thickened. Second cubital cell of the fore-wing unusually long (fig. 108).

Philippines. Two species.

Spathius capys sp. n.

♀. A dark chestnut-brown species with the head, mesonotum and gaster paler; the head in particular appears a warm shining brown. Scape, pedicel and flagellum, the latter except towards apex, yellowish-brown. Front and middle coxae honey-yellow, but the middle pair with a brownish tinge; all the femora and the hind coxae dark brown; all the tibiae brownish; the two hind pairs pale (whitish-yellow) on about basal third; the front pair of tibiae are hardly pale at base; hind tarsi pale brownish. Palpi pale yellow. Eyes bluish with green reflexions (in death only?). Fore-wings brownish but without obvious fasciation; beneath the stigma there is a faintly dark cloud and this emphasises a little the hyaline band across the middle of the wing.

Head from above almost cubical (fig. 134), hardly narrower behind the eyes than across them. Face dull, irregularly rugose-reticulate on a somewhat rugulose surface; no obvious transverse elements in the sculpture. Clypeus sharply defined, bounded by a fine semicircular carina. Frons with weak indication of transverse striation and with a small patch of scaly-reticulation against the eye-margin. Antenna broken, but decidedly a little thick; 26 segments are present on one antenna and to judge from the number of darkened apical segments and the degree of attenuation at apex, the total number would possibly be about 30; flagellum 1 a little shorter than scape plus pedicel, 11 : 13; hairs of at least the four basal segments of the flagellum pale, semi-erect, ⅔ to ¾ the width of the segments. Ocelli virtually in an equilateral triangle.

Thorax: Pronotal keel widely separated from the posterior margin, showing as a short, thickened crest on the horizontal surface of the pronotal collar and raised above the posterior margin of the pronotum; lateral area moderately well defined. Mesonotum falling abruptly but not vertically to the pronotum; lobes of the mesonotum with fine scaly-reticulation all over; on the anterior, declivous part of the middle lobe and towards the front of the lateral lobes the reticulation is closest but towards the posterior surface of the lobes, especially of the lateral lobes, the meshes become slightly larger and the general surface more shining; posterior ridges apparently anastomosed posteriorly to form a single strong carina which anteriorly sends out two much-broken forks along the course of the notauli; notaulices themselves rather feebly costate; mesonotal hairs sparse, semi-erect. Scutellum almost smooth; its anterior depression divided by a carina into two large, round hollows, in each of which is a single abbreviated ruga. Propodeum rather long, without a posterior declivous surface and without areation, except that the area petiolaris is sharply delimited, covered all over with strong, wrinkly reticulations; basal carina clearly emphasised above the surrounding rugosities but very irregular in appearance. Mesopleura: the furrow is wide, closely, strongly and deeply costate, its limits ill defined; the surface above the furrow and narrowly adjacent to it is more or less smooth and shining; elsewhere the mesopleura shows some kind of coarse sculpture. Legs: hind coxa smooth, shining, rounded beneath at base; hind tibia rather thick, decidedly swollen proximal to middle, the hairs of its upper surface about one and one-quarter times as long as the middle width of the tibia; lobe with 2 spines; hind tarsus 1 nearly 2½ times as long as 2; 3 about half 5; segment 1 of the middle tarsus about twice as long as wide; 2 hardly longer than wide. Fore-wing: 2nd cubital cell very long, the 2nd abscissa of the radius being considerably longer than the 3rd; recurrens received into the 2nd cubital at a distance equal to one-half its own length; nervus parallelus not interstitial.

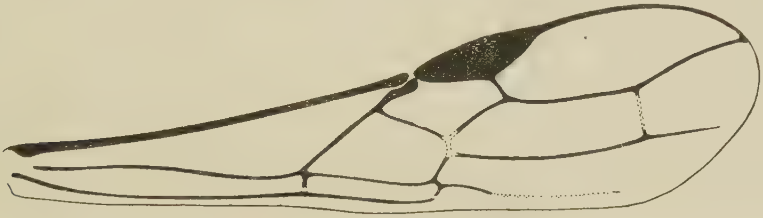


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FIG. 108.—*Spathius capys* sp. n., fore-wing, ♀.

Abdomen: Petiole about 1½ times as long as the propodeum, not elbowed in profile but a little thickened towards base; except at apex where the usual striations occur, the surface is covered with irregular reticulations, somewhat similar to those which occur on the propodeum. Ovipositor sheaths a little longer than the whole body.

Length: 4 mm. without ovipositor.

PHILIPPINES: Mindanao, Kolambugan, 1 ♀ (*Baker*).

Type in U.S. National Museum.

This is a very distinct-looking insect. It appears to have a fairly close relationship with the next species to be described but certainly with no other species or group of species dealt with in this revision.

Spathius psammathe sp. n.

Differs from *capys* as follows:—

♀. Body entirely pale brownish-yellow. Eyes brilliant green with bluish reflexions. Hind coxae and hind femora honey-brown; hind tibiae brownish, much like their femora but becoming pale transparent whitish on about basal third as in *capys*; hind tarsus pale yellow.

Face dull, rugulose, but with many fine, raised lines running in a transverse direction.

Clypeus hardly delimited. Frons with only the merest trace of sculpture. Antenna broken but one antenna with 19 segments; the total number of segments would probably be about 25.

Pronotal keel very feebly defined, medially just touching the posterior margin of the pronotum. Mesonotum decidedly dull, its hairs sparser, much less conspicuous and almost adpressed; posteriorly a single fine ridge present but no raised sculpture on either side of it. Scutellum scaly-reticulate around sides, its anterior depression crossed by three costae. Propodeum less obviously reticulate, but this may be due to the paler colour of the sclerite; but still dull, rugulose. Femora a little shorter and thicker (fig. 131); hairs of the upper surface of the hind tibia much shorter, inconspicuous, not longer than those on lower side; segments 2 and 3 of the hind tarsus shorter. Medius of the fore-wing more strongly curved so that the submedian cell is decidedly constricted beyond middle; two long sides of the 2nd cubital cell straight; in *capys* they are a little curved; nervus parallelus more or less interstitial.

Petiole closely rugulose.

Length: 2·5 mm. without ovipositor.

PHILIPPINES: I. of Basilan, 1 ♀ (*Baker*).

Type in U.S. National Museum.

Although this species differs from *capys* in many small details, the most obvious differences between the two species, apart from size and colour, are the very short hairs of the upper surface of the hind tibia and the strongly curved medius of the fore-wing in *psammathe*.

Group of **briareus** sp. n.

Spathius briareus sp. n.

♀. A slender, very strikingly coloured species.

Head and gaster orange yellow, the latter slightly infuscated on basal half of tergite (2 + 3); thorax black; petiole very dark brown. Antennae dark brown throughout, the scape and pedicel a little paler. Palpi whitish-yellow. Legs: hind pair blackish throughout; front and middle coxae pale brown; front and middle legs predominantly brownish, the middle pair, as is usual, darker than the front pair. Wings evenly brownish throughout, the stigma of the fore-wing hardly paler at base.

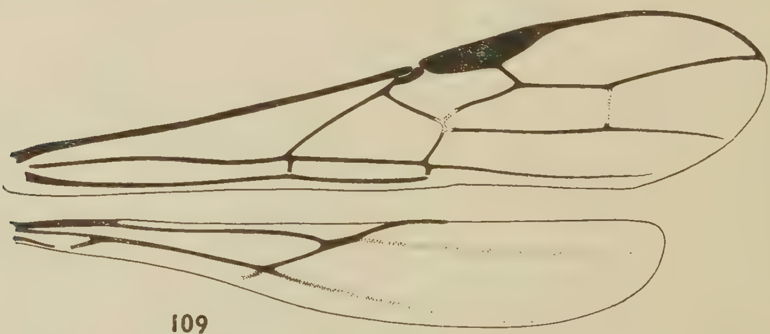

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FIG. 109.—*Spathius briareus* sp. n., wings, ♀.

Head from above almost cubical, only a little narrower behind the eyes than across them. Face with rather fine (for size of insect) confluent transverse striation, more or less interrupted along the middle. Frons with strong striation. Vertex completely smooth. Base of the ocellar triangle clearly a little longer than sides. Antenna much longer than body, with 54 segments; flagellum 1 a trifle longer than scape plus pedicel, 19 : 17; hairs of at least the four basal segments of the flagellum bristly, set at about 30 degrees and about equal to the width of the segments.

Thorax: Pronotal keel apparently undeveloped; lateral area not delimited but the depression crossed by smooth ribs which extend almost to the ventral margin of the sides of the pronotum. Mesonotum sloping somewhat gradually to the pronotum, its lobes dull, closely scaly-reticulate all over; posterior ridges long, close together, almost parallel; hairs long, nearly erect, very sparse. Scutellum almost flat, weakly scaly-reticulate, its anterior depression divided by a single ridge into two oblong, oblique foveae, in each of which the surface shows some slight inequality. Propodeum somewhat elongate; basal carina reaching to middle where it merges into irregular reticulate rugosities; no trace of an areola; dorsal areas indicated by a zone of mostly fine surface-sculpture; posteriorly they are quite undelimited. Mesopleura sculptured all over; the costae of the furrow are prolonged upwards, in somewhat obsolete form, on to the disc, and the intervals between them, on the disc, show traces of ground sculpture. Legs: hind coxae elongate, without a projection beneath at base, but in profile very bluntly angled; hind femur rather narrow; hairs of the upper surface of the hind tibia set mostly at about 45 degrees, some short, some longer, but on the whole about $1\frac{1}{4}$ to $1\frac{1}{3}$ times longer than the middle width of the tibia; apical lobe with 3 inconspicuous spines; fringe 2–3; hind tarsus 1 slightly less than twice 2, 9 : 5; 3 considerably shorter than 5, 11 : 15. Wings (fig. 109), long, narrow; recurrens almost interstitial.

Abdomen: Petiole very long and narrow, almost 3 times as long as the propodeum, its sculpture, except towards the apical dilatation, mostly transverse in direction; gaster long, narrow, about $2\frac{1}{2}$ times as long as its greatest width. Ovipositor sheaths a trifle shorter than the whole body.

Length: 7·5 mm. without ovipositor.

UGANDA: Nambadzidza, 15.v.1927, 1 ♀ (*G. R. L. Hancock*).

Type in British Museum (Natural History).

A very distinctive and handsome species without close allies. Its slender form and colour render it characteristic, but in details of structure and sculpture it presents no peculiarity.

Group of **apidanus** sp. n.

Spathius apidanus sp. n.

♀. Rather dark brown to the naked eye. Head yellowish-brown, especially yellowish behind the eyes; thorax dark brown, but with a dull reddish flush; the lateral lobes of the mesonotum are decidedly darker (almost blackened) than the middle lobe; petiole reddish-brown but becoming bright yellowish in apical third; gaster brown, slightly paler than the dark part of the petiole. Scape, pedicel and base of the flagellum pale brownish-yellow. Palpi whitish-yellow. Front and middle coxae whitish-yellow; hind coxae brown; all the femora more or less brown throughout, the base showing no trace of paler colour, but the apex at sides with a very faint yellowish tinge; all the tibiae brown but becoming faintly yellowish at apex. Fore-wing dark brown with, to the naked eye, a conspicuous pale fascia a little distal to middle, and a short, rather inconspicuous pale fascia marking the course of the 2nd transverse cubitus.

Head transverse, considerably narrower behind the eyes than across them. Face with shining, confluent, transverse striation. Frons rather finely striate-rugose all over. Vertex, except on posterior declivous part, which is nearly smooth, closely wrinkly striate; the transverse striate element is virtually lost in the middle part of the vertex, but becomes well defined towards the temples. Base of the ocellar triangle very slightly longer than its sides. Antennae broken but with 28 segments present; the flagellum very slender;

flagellum 1 about 1½ times as long as scape plus pedicel, 20 : 13; hairs of the basal flagellar segments about as long as the width of the segments.

Thorax: Pronotal keel well defined, sharp, widely separated from the posterior margin of the pronotum; lateral depression rather poorly defined, crossed by 3–4 widely spaced carinae. Mesonotum sloping somewhat gradually to the pronotum, its hairs very sparse, outstanding; the middle lobe almost all over has a fine sculpture consisting of minute transverse ripples (*i.e.*, scaly-reticulation which has become broken and has developed transverse tendencies); strong transverse rugae encroach from the course of the notaulices on to the lateral lobes but they hardly reach the middle lobe and leave free a large, dull, oblong area of close scaly-reticulation; posterior ridges clearly emphasised. Scutellum very feebly convex, shining, with traces of scaly-reticulation; its anterior depression crossed by 3–4 rather poorly defined costae. Propodeum completely areolated; basal carina long, fully twice as long as the short forks; dorsal areas sharply delimited, shining, with a few obsolescent rugae; ridge separating the areola from the area petiolaris hardly emphasised; no trace of posterior protuberances. Mesopleura sculptured all over; the costae of the furrow extend, in the form of shining, much confluent striation, on to the disc and converge towards the posterior fovea; the posterior part of the disc is smoother than elsewhere. Legs: hind coxa with a well-defined basal projection; hind femur very gradually and evenly narrowed to base (fig. 130); hairs of the upper surface of the hind tibia rather short, semi-erect, about as long as the middle width of the tibia; apical lobe with 3 rather long spines; hind tarsus 1 twice 2; 3 as long as 5. Fore-wing: recurrens arising from the nervus parallelus at a distance from the apex of the 2nd discoidal cell equal to ⅔ its own (of recurrens) length: recurrens received into the 2nd cubital cell at a distance from the intercubitus equal to ¾ its own length; 2nd abscissa of the mediella of the hind-wing a little more than twice the length of the 1st.

Abdomen: Petiole long, narrow, about 2½ times as long as the propodeum; its sculpture, except towards the apical dilatation where fairly regular striation occurs, feeble, almost wanting and virtually without longitudinal elements. Ovipositor sheaths as long as the body.

Length: 6·5 mm. without ovipositor.

Aru: 1 ♀ (F. Smith Coll.).

Type in British Museum (Natural History).

A very distinctive species characterised by the long first flagellar segment, dark wings with their unusual venation, shape of the hind femur and long, narrow petiole with its yellow apex.

I am at a loss to suggest allies. The dark fore-wing with its conspicuous hyaline fascia is an unusual feature in a species with smooth gaster.

Group of *alipes* Wilkinson.

Characters:—Head always very decidedly narrower behind the eyes than across them. Infraclypeal cavity 2–3 times as wide as long.

Mesonotum falling more or less perpendicularly to the pronotum and always raised high above this. Propodeum always distinctly areolated in so far as the dorsal areas and areola are always sharply defined, though the latter, exceptionally, may be confluent with the area petiolaris as in *opis* sp. n. Hairs of the upper surface of the hind tibia, when this is seen in profile, made up of long and short hairs (in *opis* only long hairs); the contrast between the two lengths of hairs sometimes not very marked; apical lobe of the hind tibia usually without spines; rarely with two inconspicuous ones; hind coxa with a well-developed basal projection. Wings faintly but evenly brownish, without a trace of fasciation; 1st and 2nd abscissae of the radius virtually in a straight line, except in *opis* sp. n., where they form a slight angle.

Abdomen: Petiole usually of slender build but less so in the African species. Gaster completely smooth. Ovipositor, except in *opis* sp. n., always at least as long as the whole body.

AFRICA. INDO-AUSTRALIAN REGION. JAPAN. Nineteen species; two subspecies; one variety.

The salient features of the group reduce to two, namely, the wide mouth opening and the position of the 1st and 2nd abscissae of the radius in relation to each other.

I can find no line of division between the African and Indo-australian species.

The forms from Java, extending through Borneo, New Guinea, and the Philippines to Japan, appear to show, with rare exceptions, a very uniform and rather striking colour pattern which, as far as the material I have studied enables me to judge, is not suggested in any of the African species. This pattern is described fully in the discussion of *alipes* Wilkinson and its near allies.

Another point of interest is that in African species the mesonotum is usually black while in Indo-australian forms it is almost always reddish or yellowish. Thus, out of the eight species I record from Africa, seven have the mesonotum dark, while out of the eleven from the Indo-australian region, nine have it entirely pale.

Key to the species of the *alipes* group.—Females.

1. Lobes of the mesonotum strongly shining, polished and virtually smooth at a magnification of × 60; (notaulices widely foveate; posterior ridges sharply defined, the space between them smooth) *eunyce* sp. n. (p. 284).
–. Lobes of the mesonotum always with some kind of sculpture all over . . 2.
2. Asiatic species . . . . 3.
–. African species . . . . 16.
3. Mesonotum black or with at least the lateral lobes blackened . . . . . 4.
–. Mesonotum entirely pale, either reddish or testaceous-yellow . . . . 6.
4. Lobes of the mesonotum in far greater part very strongly and coarsely sculptured; propodeum very sharply areolated, its areas more or less smooth and highly polished; head contrasting yellowish-red, the mesonotum coal-black . . . . *dido* sp. n. (p. 285).
–. Lobes of the mesonotum in far greater part very finely sculptured; propodeum not appearing very sharply areolated, its areas with numerous rugosities of indefinite appearance; no such contrast . . . . 5.
5. Mesopleura reddish; mesonotum with at least a reddish suffusion within the posterior depression . . . *opis* v. *rufovariegatus* var. n. (p. 289).
–. Mesopleura more or less blackish; mesonotum black *opis* var. ? (p. 289).
6. Upper surface of the hind tibia in profile showing only very long hairs; 1st and 2nd abscissae of the radius clearly not in a straight line. (Sp. with the flagellum dark throughout; petiole decidedly short, markedly rugose-reticulate) . . . . *opis* v. *rufovariegatus* var. n.
–. Upper surface of the hind tibia in profile showing numerous short hairs (about half as long) as well as longer hairs (fig. 122); 1st and 2nd abscissae of the radius virtually in a straight line (fig. 110) *alipes* group (s.str.), 7.
7. Vertex entirely smooth. (Spp. having the middle lobe of the mesonotum with strong shining rugae which are often complete right across and at most interrupted along the middle line) . . . . 8.
–. Vertex with at least traces of fine striation or if more or less smooth, then the middle lobe by no means as strongly sculptured as above . . . . . 10.
8. Basal carina of the propodeum much longer than its forks; flagellum with only two yellow segments near apex; no dark patch behind the eyes *ceto* sp. n. (p. 282).
–. Basal carina of the propodeum about as long as its forks; flagellum with at least 4 yellow segments near apex; a dark patch behind the eyes. . . 9.

9. Frons sculptured; propodeum entirely black . . *melpomene* sp. n. (p. 280).
—. Frons smooth; propodeum reddish . . . . *erigone* sp. n. (p. 282).
10. Vertex very coarsely sculptured, the sculpture spreading down over the post-genae; hind coxae dark at base. . . . *cydippe* sp. n. (p. 284).
—. Vertex much less coarsely sculptured, and in any case the sculpture never extending down over the post-genae; hind coxae pale throughout . . 11.
11. Mesopleura and mesosternum entirely reddish, same colour as the mesonotum *medon* sp. n. (p. 286).
—. Mesopleura and mesosternum darkened at least in part or if more or less entirely reddish, then clearly not the same colour as the mesonotum, the latter being decidedly yellowish in tint . . . . 12.
12. Stigma entirely pale, brownish-white. (Hairs of at least the six basal flagellar segments pale, not longer than the width of the segments; long hairs around the rim of the flagellar segments clearly emphasised, outstanding) . . . . 13.
—. Stigma dark, pale at most at base . . . . 14.
13. Flagellum without yellow preapical segments . . *enippe* sp. n. (p. 279).
—. Flagellum with yellow preapical segments *enippe* subsp. *procne* subsp. n. (p. 280).
14. Lower part of the face invariably darkened . . . . *alipes* Wilk. (p. 277).
—. Lower part of the face not darkened . . . . 15.
15. Propodeum black; dorsal surface of the gaster darkened only on roughly basal half of tergite (2 + 3) *alipes* Wilk. subsp. *kokodaensis* subsp. n. (p. 278).
—. Propodeum reddish; dorsal surface of the gaster with a dark band on tergites 4–5 as well as being darkened on most of tergite (2 + 3) *japonicus* Watanabe (p. 279).
16. Hairs of the upper surface of the third tibia, seen from the side, all long, about 2½ times as long as the middle width of the tibia. (Spp. without yellow preapical flagellar segments) . . . . 17.
—. Hairs of the upper surface of the hind tibia composed of short and long hairs or hairs of much the same length but in any case the longest of them are at most 1½ times as long as the middle width of the tibia . . . 18.
17. Vertex striate . . . . *bruesi* Wilkinson (p. 287).
—. Vertex completely smooth . . . . . . *opis* sp. n. (p. 288).
18. Propodeum densely pubescent all over, even within the dorsal areas *tricolor* Szepligeti (p. 292).
—. Propodeum with at least the dorsal areas free from hairs, except perhaps for a few posteriorly . . . . 19.
19. Vertex striate . . . . 20.
—. Vertex smooth . . . . 22.
20. Longer axis of eye 3 4 times as long as the malar space; flagellum with yellow preapical segments . . . . 21.
—. Longer axis of eye twice as long as the malar space; flagellum without yellow preapical segments. (Sp. with the head in greater part fulvous) *bruesioides* sp. n. (p. 290).
21. Head blackish . . . . *transversalis* Szepligeti (p. 291).
—. Head entirely fulvous (contrasting sharply with the black thorax) *thyas* sp. n. (p. 293).
22. Body entirely fulvous . . . . . . *laeviceps* Brues (p. 291).
—. At least the mesonotum black . . . . 23.
23. Head uniformly dark brown; flagellum with yellow preapical segments *transversalis* Szepligeti (p. 291).
—. Head fulvous with a dark patch on frons extending to a greater or less degree on to the vertex; flagellum without yellow preapical segments *caudatus* Szepligeti (p. 294).

Spathius alipes Wilkinson.

Spathius alipes Wilkinson, 1931, *Trans. ent. Soc. Lond.* **79** : 512, ♂♀.

♀. Head pale reddish-yellow, the lower part of the face frequently darkened, almost brownish; the region around the antennal insertions rather markedly yellowish; the darkened lower part of the face is enhanced by the pale upper part; mesonotum, scutellum and postscutellum evenly unicolorous, much like the head but a little redder; propodeum virtually black, at most the apex a little reddened; mesopleura darkened, almost blackened over most of its surface but becoming red beneath the wing insertions; sides of the pronotum darkened medially but becoming red along the dorsal margin; the mesosternum dull reddish but sometimes more or less black; the red of the sides of the thorax is usually deeper in tint than that of the dorsal surface; petiole dark reddish to almost black, but pale at extreme apex; gaster brownish-red, yellowish at extreme apex and along the ventral surface; the dark colour of tergite (2 + 3) spreads downwards on to the ventral surface of the gaster, where it forms a usually sharply discrete bilobed patch. Antennae reddish-yellow over about basal quarter, thence becoming dark brown and with 4–13 yellow segments near apex, 4–5 in type series. Palpi whitish-yellow. Legs, apart from the tarsi, yellow throughout, the hind femora sometimes a little darkened on each side; hind tarsi brown, the other pairs very slightly so. Stigma only very slightly paler at base.

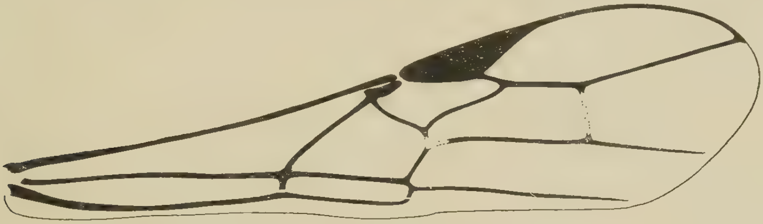

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FIG. 110.—*Spathius alipes* Wilkinson, fore-wing, ♀.

Head much narrower behind the eyes than across them (fig. 115). Face with smooth rather weak, subconfluent transverse striation, which is more or less obliterated along the middle line. Frons rather strongly, transversely striate. Vertex very finely striate, the striation sometimes obsolescent, not or hardly extending on to the temples. Antenna with 41 segments (2 ♀♀); flagellum 1 very distinctly longer than scape plus pedicel, about 15 : 11; general vestiture of the flagellum long, bristling, the long hairs around the rim of the segments by contrast not outstanding (fig. 125). Longer axis of the eye nearly four times as long as the malar space, 34 : 9. Ocelli almost in an equilateral triangle; furrow on each side of the posterior ocelli weak and inconspicuous.

Thorax: Pronotal keel weakly developed, fused with the posterior margin of the pronotum medially; lateral area fairly well developed, crossed by a few smooth, rather weak costae. Mesonotum with its middle lobe on the whole finely sculptured, with less raised rugosities present than, for example, in *melpomene* sp. n. (fig. 113); lateral lobes with a longitudinal zone of fine surface sculpture; the transverse rugae between this zone and the notaulices are rather weak and have not a smooth appearance, the intervals between them showing traces of surface sculpture; posterior ridges well defined but irregular. Scutellum almost flat, its anterior depression with 3 sharp keels dividing it into 4 virtually smooth hollows. Propodeum: basal carina varying from about equal to about 1½ times as long as its forks; dorsal areas shining, with only traces of surface sculpture and with a few hairs posteriorly; areola separated from the area petiolaris by a well-emphasised but short keel; no trace of posterior protuberances. Disc of the mesopleura smooth, shining;

furrow consisting of a row of smooth foveae. Legs long and slender; front tarsus a little longer than its tibia, 5 : 4; projection of the hind coxa rather feeble; hind femur fairly evenly tapering to base; hairs of the upper surface of the hind tibia as in fig. 122; the longest hairs are semi-erect and about half as long as the middle width of the tibia; apical lobe without spines; hind tarsus 1 a trifle less than twice 2, 24 : 13; 3 is $\frac{3}{4}$ of 5. Wings (fig. 110).

Abdomen: Petiole about twice as long as the propodeum, narrow, a little constricted in apical half, its surface appearing somewhat smooth and its sculpture, except in apical third where longitudinal ridges are well defined, decidedly obsolescent. Ovipositor sheaths a little longer than the body, about 5 : 4.

Length: 4–4·5 mm. without ovipositor.

♂. Like the female but a good deal smaller in the series examined. Colour of the thorax more diffuse, the black portions frequently dull reddish; gaster more or less evenly brownish above and below. Flagellum without yellow preapical segments. Sculpture of the mesonotum a little finer, appearing dull and rugulose. Hind-wing without a false stigma.

Length: 3–3·5 mm.

JAVA: Tjibodas, 5–7000 ft., viii.1913, type series consisting of 6 ♀♀ and 13 ♂♂ (*Koningsberger*). BORNEO: Sandakan, 6 ♀♀ (*Baker*). PHILIPPINES: Sulu Archipelago, I. of Basilan, 9 ♀♀ (*Baker*). NEW GUINEA: Papua, Mafulu, 4000 ft., i.1934, 1 ♀ (*L. E. Cheesman*).

Type in British Museum (Natural History).

The examples from Basilan are on the average a little smaller than those from Java and Borneo and tend to have the mesopleura more extensively reddened and the propodeum frequently reddened all over; the larger the individual the darker the propodeum.

All examples from Borneo and Basilan have the petiole reddish more or less throughout.

Not leaving out of consideration that the amount of material I have studied is small, I can find no adequate evidence to support the possibility that *alipes* has developed a number of distinct geographical forms, with a single exception, which will be treated next.

The number of yellow segments to the flagellum seems to be variable within rather wide limits. Unfortunately, the antennae, being very fragile structures, are usually broken off. In one female from Borneo, there are nine preapical yellow segments and five dark apical ones. In three females from Basilan, the flagellum shows 11–13 yellow segments with one or two dark ones beyond them. It is possible that if enough perfect examples were available, there might be found in the number of pale flagellar segments a basis for dividing the forms into geographical races. But at present, as I have already said, I do not think the evidence is adequate.

Spathius alipes Wilkinson subsp. **kokodaensis** subsp. n.

This is a more intensely coloured insect than the typical form, with which I compare it as follows :—

♀. *Head* evenly reddish-yellow all over; gaster reddish-yellow (almost chestnut red) with the *basal half of tergite* (2 + 3) *brown*; sometimes the brown colour is reduced to an ill-defined patch on each side of the tergite; the epipleura of tergite (2 + 3) show a dark brown bilobed patch similar to that of *alipes* and equally sharply delimited on the ventral side; this brown patch is usually not continuous with the brown of the dorsal surface, being separated from it anteriorly by a pale streak and posteriorly by a pale blotch, which just embraces the posterior spiracle; the apex of the gaster is not paler. Flagellum with

13–18 yellow preapical segments: 13 (3 ♀♀); 14 (1 ♀); 16 (1 ♀); 18 (1 ♀). Legs decidedly redder in tint, more especially the hind femora.

Vertex with strong transverse striation; in the smallest specimen stronger than in average-sized individuals of *alipes* and more transverse in direction. Hairs of the flagellum slightly shorter (fig. 126).

Petiole a trifle shorter and a little more rugose.

♂. Like the female but the colour of the gaster more diffuse; in the one male in which the antennae are complete, all the flagellar segments are dark as in *alipes* ♂.

New Guinea: Papua, Kokoda, 1200 ft., iv.1933, 2 ♀♀, 1 ♂; vii, 1 ♀; ix.1933, 9 ♀♀, one the type; x.1933, 1 ♂ (*L. E. Cheesman*).

Type in British Museum (Natural History).

Caution is necessary in interpreting the colour-pattern of the gaster and allowance should be made for the considerable amount of variation which occurs. On the whole, however, the infuscation on tergite (2 + 3) does render the gaster distinctive looking.

Of all the differences mentioned above in the comparative description, the most significant is probably the shorter vestiture of the flagellum and the most easily appreciated the non-darkened lower part of the face. It is of course quite likely that I am here dealing with a form sufficiently distinct from *alipes* to deserve specific status and the possibility is strengthened by the fact that I record a more or less typical *alipes* from Papua, Mafulu.

Spathius japonicus Watanabe.

Spathius japonicus Watanabe, 1937, *J. Fac. Agric. Hokkaido Imp. Univ.* **42**: 36.

This species, of which thanks to the great generosity of Mr. Watanabe, the British Museum now possesses a female paratype, is extremely like *alipes* and its close allies. It differs from *alipes* as follows:—

♀. Head more or less honey-brown; face not darkened below; mesopleura black almost all over; mesosternum black; propodeum bright reddish but the metapleura nearly black; petiole bright reddish like the propodeum but darkened beneath; tergites 7 and 8 honey-yellow; the gaster otherwise chestnut brown with three indistinct pale bands; as in *alipes*, the brown of tergite (2 + 3) spreads on to the ventral surface of the gaster where it forms a sharply discrete bilobed patch. All the tarsi yellowish. Stigma rather pale, unicolorous.

Vertex more strongly striate. Vestiture of the flagellum shorter. Hardly a trace of a furrow skirting the posterior ocelli. Basal carina of the propodeum about half as long as its forks.

Japan: Hirooka, Tosa (*H. Okamoto*).

Spathius enippe sp. n.

♀. Differs from *alipes*, which it resembles very closely, as follows:—

Mesopleura deep reddish all over; propodeum dull reddish above; gaster on the whole paler above, more yellowish-red and without a contrasting yellowish apex. Flagellum without yellow preapical segments. Hind femora always darkened at apex; hind tarsi less conspicuously brownish. Stigma pale testaceous yellow.

Hairs of the flagellum considerably shorter (fig. 124). Sculpture of the vertex more obsolescent, sometimes almost absent.

Philippines: Baguio, Benguet, 4 ♀♀, one the type (*Baker*); a fifth female from the same locality, a small example, has the thorax entirely and evenly pale reddish-yellow with the upper surface of the gaster conspicuously yellowish, the lower surface being decidedly darker. I also refer to this species a female from Mindanao, Davao (*Baker*) and another from Port Banga (*Böttcher*) in which the mesopleura is decidedly darkened.

Type in U.S. National Museum.

At first I was inclined to regard this species as merely a geographical race of *alipes* but since it differs constantly in two well-defined features, *i.e.*, vestiture of antennae and colour of the stigma, it seems better to give it a specific name. I do not regard the lack of yellow preapical flagellar segments as having more than racial significance but on the other hand I should not expect to find much variation here within the limits of the geographical race itself. Accordingly, I consider the two insects to be mentioned next as constituting a local race of *enippe* because they do show some yellow flagellar segments.

Spathius enippe subsp. **procne** subsp. n.

♀. Differs from typical *enippe* as follows :—

Generally paler in colour, the upper surface of the gaster more yellowish in tint. Hind femora hardly infuscated at apex; hind tarsi hardly darkened at all. Flagellum with about 8 preapical segments.

Vertex with stronger striation. Furrow skirting the ocelli hardly marked.

PHILIPPINES : Los Baños, 2 ♀♀, one the type (*Baker*).

Type in U.S. National Museum.

Although I have associated this form with *enippe*, it may well be a race of *japonica* which it resembles very closely, the chief differences being in colour. The stigma of race *procne* is decidedly paler than in *japonica* and the gaster, in addition to being paler, has a much more diffuse coloration, while in the Japanese species there is quite a marked tendency towards the formation of a colour pattern; the sharply discrete brown patches on the side of the gaster in *japonica* are not present in *procne*. The points of resemblance to *japonica* are (1) yellow preapical flagellar segments, (2) equally strongly striate vertex and (3) reddish propodeum.

The resemblance of race *procne* to *japonica* naturally calls into question the status of *enippe*. Are all three forms merely geographical races of the same species, namely *japonica* Wat.? Until more material is collected it is difficult to see how the question can be decided.

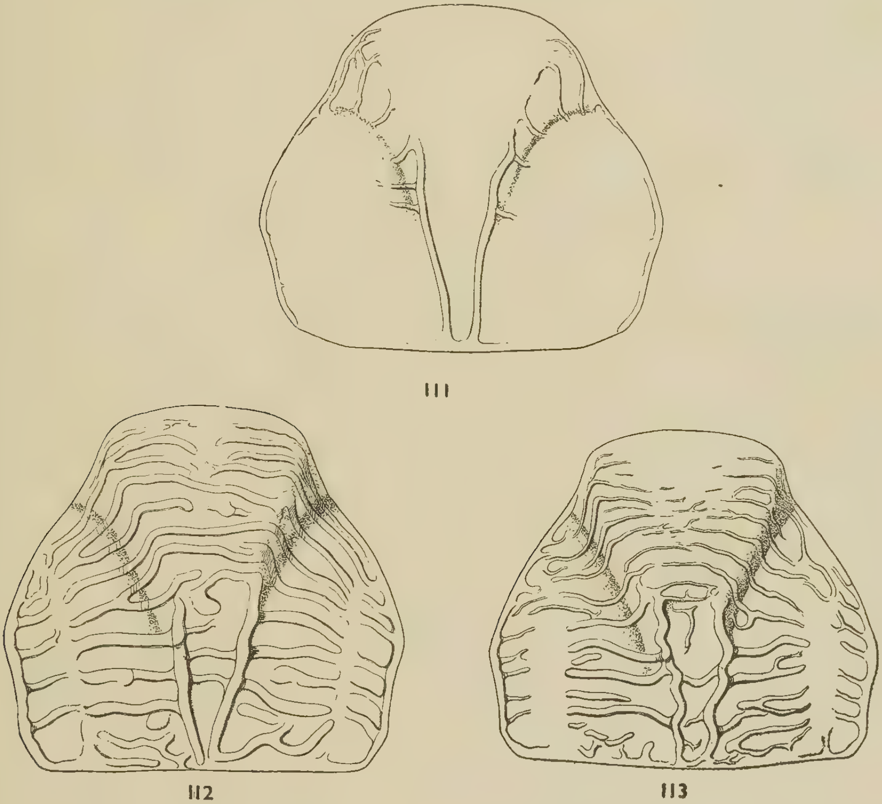
Spathius melpomene sp. n.

♀. The general colour pattern as in *alipes* Wilk., but the colours themselves rather more intense and producing sharper contrasts.

Head yellowish to reddish testaceous with a brownish cloud behind each eye; face below not at all darkened; mesonotum and scutellum more or less the same colour as the head; mesosternum, most of the mesopleura, the propodeum and a greater or less extent of the pronotum black; the upper part of the mesopleura and a greater or less extent of the pronotum deep wine red; petiole on the whole very dark, blackish at least in basal half, then becoming a little reddened towards apex; gaster yellowish-red with indication of faint yellowish bands at apex of tergites laterally; apex of gaster (tergites 7, 8 and part of 6) always more or less yellowish. Flagellum with 9–11 bright yellow preapical segments. Hind femora always infuscated in apical half; hind tarsi brownish. Stigma dark, virtually not paler at base.

Head much narrower behind the eyes than across them (fig. 121). Face with rather strong shining broken striation, more or less obliterated along the middle line. Frons with strong shining but very irregular transverse striation. Vertex completely smooth but with a deep smooth furrow skirting each posterior ocellus; these two furrows almost join behind the ocelli and each terminates anteriorly in a large pit; a single furrow of much the same depth joins the anterior extremities of the lateral furrows and touches the anterior ocellus. Antenna with 46–47 segments (3 ♀♀); flagellum 1 very distinctly longer than scape plus pedicel, 4 : 3; its vestiture similar to that of *alipes* (cf. fig. 125). Ocelli arranged almost in an equilateral triangle. Eyes rather large, very bulging, their longer axis three times the malar space.

Thorax: Pronotal keel present only medially where it shows as a very feeble ridge, close to, parallel with, but not touching the posterior margin of the pronotum; lateral area well defined, smooth. Mesonotum falling more or less perpendicularly to the pronotum, its lobes covered with very strong smooth rugae which on the middle lobe are more or less obliterated along the middle line and on lateral lobes leave free a very narrow, linear, slightly elevated zone which is shining and has only the merest trace of ground sculpture (fig. 112). Scutellum flat but with very thick more or less transverse rugae; anterior depression divided by a complete medial costa into two foveae in each of which is an abbreviated costa. Propodeum: basal carina as long as its forks; dorsal areas with a few thick transverse rugae posteriorly; these are sometimes obsolescent. Mesopleural furrow almost smooth, except for the posterior costa, at most traces of costulae being present; disc all over with faint indication of a scaly-reticulate ground sculpture. Legs as in *alipes* (cf. fig. 122) except that segment 3 of the hind tarsus is a trifle shorter in proportion to 5



Figs. 111–113.—Mesonotum of *Spathius*:—111. *Spathius eunyce* sp. n.; 112. *S. melpomene* sp. n.; 113. *S. alipes* Wilkinson.

and the lobe of the hind tibia has 2 fine spines. Recurrens received into the 2nd cubital cell at a distance equal to about one-third its own length.

Abdomen : Petiole long and slender, slightly more than twice as long as the propodeum; in apical half almost smooth and markedly constricted; gaster somewhat narrowly ovate, a trifle more than twice as long as wide, 67 : 30. Ovipositor sheaths a little longer than the body, about 13 : 11.

Length : 4·6–5·5 mm. without ovipositor.

♂. Like the female, but the flagellum dark throughout. Subcostella beyond the apex of the median cell only very slightly thickened. Hind tarsus 3 slightly shorter in proportion to 5 than in female.

Length : 4·2 mm.

PHILIPPINES : Mt. Makiling, 3 ♀♀, one the type; 1 ♂; Mt. Banahao, 4 ♀♀ (*Baker*).

Type in U.S. National Museum.

This species is essentially characterised by the combination of smooth vertex, sculptured frons and coarsely sculptured mesonotum.

Spathius erigone sp. n.

This species is remarkably similar to *melpomene* and yet can be easily separated from it by the characters given in the key. A detailed comparison is as follows :—

♀. Size on the average smaller. Mesopleura more extensively reddened, almost the whole of the disc being pale; propodeum reddish, the metapleura less so; the largest individuals, which equal *melpomene* in size, but which form a small minority of the specimens available, approximate more to *melpomene* in colour in that the sides of the thorax are more extensively blackened than in smaller examples; petiole reddish; gaster with less clearly defined yellow patches. Number of yellow preapical segments of the flagellum varying from 3 to 6, but sometimes there are no clearly yellow segments, though the apical segments have a greyish appearance.

Frons entirely smooth. Scutellum without thickened rugae; at most with traces of surface sculpture; anterior depression usually with three clearly defined costae, but sometimes the lateral ones abbreviated. Gaster less narrow; some caution is needed in interpreting this last feature, for I cannot be certain that the difference may not be due to distortion.

♂. Hind-wing with false stigma (fig. 129).

Length : 4·5 mm. without ovipositor.

PHILIPPINES : Luzon, Mt. Makiling, 10 ♀♀, one the type, 1 ♂ (*Baker*).

Type in U.S. National Museum.

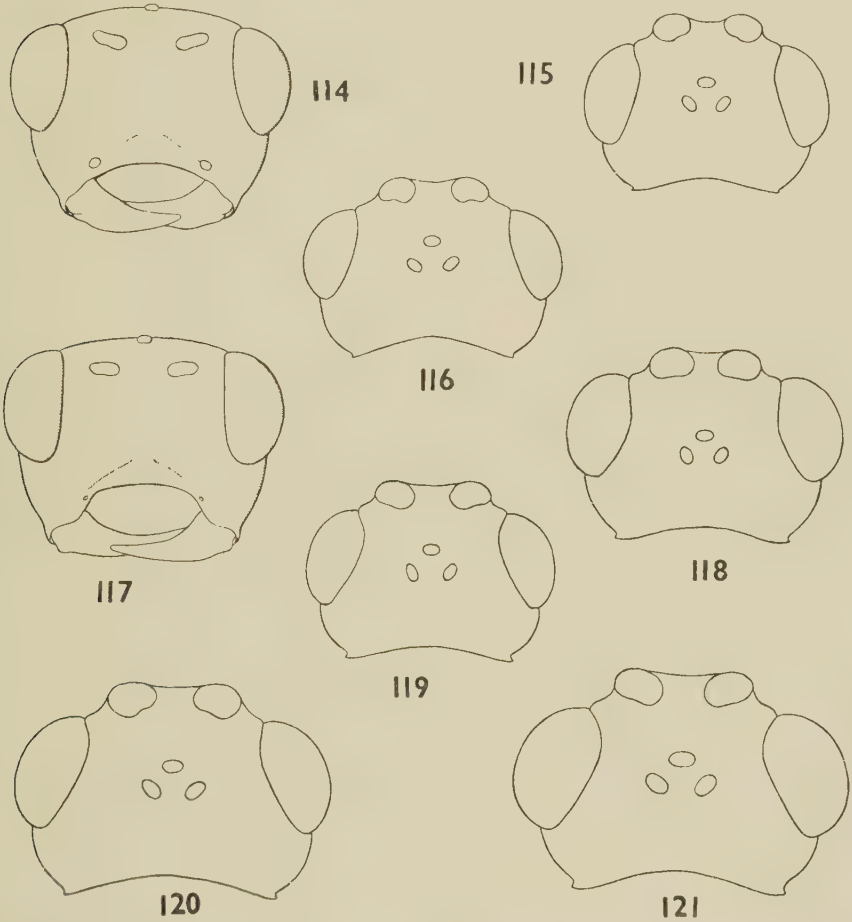
Spathius ceto sp. n.

This species is extremely closely allied to *melpomene* and *erigone*, resembling *melpomene* in having sculpture on frons, and *erigone* in having red on the propodeum. From both it differs in the shape of the head as seen from above (fig. 119). It may be compared with *melpomene* as follows :—

♀. Head without a yellow tint, being more or less pale honey-brown, but darkened everywhere behind the eyes and on the lower part of the face; mesonotum redder in tint; mesosternum reddened, more especially in the type; propodeum reddened but less so towards the sides; gaster more or less evenly yellowish, the colour somewhat dingy; petiole somewhat reddened above. Flagellum with two bright yellow segments proximal to seven dark ones.

Head less transverse as seen from above (fig. 119), not so narrow behind the eyes. Antenna with 38–39 segments. Face almost smooth; there is a little transverse rugosity on each side of the medial elevation just above the middle but elsewhere and especially towards the clypeus, the surface is smooth, polished except for a few, isolated indistinct punctures. Eyes a little smaller. Flagellum 1 a little shorter in proportion to the combined lengths of scape and pedicel.

Mesonotum: rugae of the middle lobe less narrowly interrupted along the middle line; posterior ridges broken down and not distinguishable as such among the surrounding rugosities. Scutellum with raised rugosities but these are less characteristic than in *melpomene*. Propodeum a little narrower; basal carina about twice as long as its forks. Long hairs of the upper surface of the hind tibia a little longer and more erect.



Figs. 114–121.—Head of *Spathius*:—114. *Spathius bruesi* Wilkinson; 115. *S. alipes* Wilkinson; 116. *S. bruesi* Wilkinson; 117. *S. opis* sp. n., type; 118. *S. eunyce* sp. n.; 119. *S. ceto* sp. n.; 120. *S. dido* sp. n.; 121. *S. melpomene* sp. n.

Petiole a little shorter, its surface more obviously rugose.

Length: 4 mm. without ovipositor.

Philippines: Mindanao, Dapitan, 2 ♀♀, one the type (*Baker*).

Type in U.S. National Museum.

Probably characteristic of *ceto* is the lack of definition of the posterior ridges of the mesonotum but more material would be necessary to establish the value of this criterion as a diagnostic feature of the species. On the other hand, from my experience of the way in which the arrangement of the mesonotal sculpture can vary in *Spathius*, I should expect this lack of definition of the posterior ridges to be a fairly sound specific character.

Spathius cydippe sp. n.

This species may be compared with *melpomene* as follows :—

♀. Face darkened below, that is, redder than the other parts of the face in tint. Mesonotum and scutellum decidedly reddish in tint and producing none or only a very feeble contrast with the other red parts of the thorax; propodeum entirely reddish but the metapleura sometimes a little darkened; mesosternum virtually black, at most a little reddened in the middle posteriorly; petiole entirely reddish, similar in colour to the propodeum; gaster more or less evenly reddish-brown to reddish-yellow; not darker beneath. Flagellum with 11–13 yellow preapical segments. All the coxae brownish at base. Stigma of the fore-wing dirty yellow.

Frons with strong wrinkly rugosity. Vertex strongly striate; the striation to the sides of, and immediately behind, the ocelli tends to become very much wrinkled; towards the temples the striation runs obliquely between the eye-margin and the occipital margin; the rugosity of the vertex spreads downwards over the temples to within one-third to one-half of the lowest point of the eye. Hairs of the flagellum a trifle shorter and finer.

Mesonotum having a less shining appearance, more confusedly rugose than in *melpomene*, but the rugae less thick. Dorsal areas of the propodeum with better defined transverse rugae posteriorly. Mesopleural furrow costate throughout; disc without surface sculpture, shining, smooth except for isolated, hardly noticeable ill-defined punctures. Lobe of the hind tibia without spines.

Petiole a little shorter.

Length : 3·5–4·5 mm. without ovipositor.

Philippines : Luzon, Mt. Makiling, 4 ♀♀; Los Baños, 1 ♀ (*Baker*); I. Polillo, viii.1915, 2 ♀♀, one the type (*Böttcher*).

Type in British Museum (Natural History).

S. cydippe sp. n. differs from all the other species in the group in the degree of intensity and extent of the sculpture of the vertex.

Spathius eunyce sp. n.

♀. More or less honey-brown with paler or darker suffusions; the head is sometimes honey-yellow but the vertex in all examples is very faintly darker above. Lobes of the mesonotum strongly embrowned; gaster varying in colour according to the size of the individual; in large females it is decidedly brown but in small ones it has a yellowish tint. Scape and pedicel somewhat brownish; flagellum without yellow preapical segments. All the coxae honey-yellow; hind femora a little infuscated on upper and outer side; hind tibiae faintly darkened but remaining pale on about basal quarter; all the tarsi dark brown. Stigma dirty yellow.

Head seen from above as in fig. 118. Face almost smooth; at most the merest trace of remote very ill-defined punctures. Frons and vertex completely smooth. Antenna with 49–53 segments (2 ♀♀); flagellum 1 only a little longer than scape plus pedicel, 16 : 13; hairs of the flagellum decidedly short, close and not bristly. Ocelli almost in an equilateral triangle. Eyes rather small, their longer axis about 2½ times as long as the malar space.

Thorax: Pronotal keel feeble, medially almost contiguous with the posterior margin of the pronotum; lateral area sharply delimited, almost smooth. Mesonotum falling more or less perpendicularly to the pronotum, its lobes shining, polished; at a magnification of 60 diameters there is virtually no trace of surface sculpture; posterior ridges sharply defined, the space between them smooth; distribution of raised sculpture as in fig. 111; hairs very sparse, more or less erect and restricted to the margins of the notaulices. Scutellum smooth, shining, very feebly convex from base to apex; this is more especially noticeable posteriorly; anterior depression with three strong costae. Propodeum: basal carina one-quarter to one-third the length of its forks; dorsal areas more or less smooth. Disc of the mesopleura smooth, polished; furrow smoothly costate. Legs: hind coxa with a sharp dentiform projection; hind femur slightly less tapering to base than for example in *alipes* (cf. fig. 122); hairs of the upper surface of the hind tibia rather short, only a little longer than the middle width of the tibia; lobe without differentiated spines; hind tarsus 1 less than twice 2, 12 : 7; 3 as long as 5. Recurrens of the fore-wing received into the 2nd cubital cell at a distance equal to from one-third to one-half its own length.

Abdomen: Petiole about 1⅔ as long as the propodeum, shorter than in *melpomene* and its close allies, vaguely rugose. Ovipositor sheaths considerably longer than the body, about 8 : 5.

Length: 4·5 mm. without ovipositor.

PHILIPPINES: Luzon, Mt. Makiling, 8 ♀♀, one the type (*Baker*).

Type in U.S. National Museum.

An interesting and isolated species, differing from all the others dealt with in this monograph by the polished lobes of the mesonotum. I have no doubt in my mind, however, that it belongs to the group of *alipes* Wilkinson, though it is certainly an aberrant member of this complex of species.

Spathius dido sp. n.

♀. Head rust-red; no darkening on face; dorsal surface of the thorax, including whole of propodeum black; pronotum, mesopleura and mesosternum suffused with dull red; petiole blackish but reddish at extreme apex; gaster very dark brown, almost black, both above and below, but with a slight reddish tint, more especially noticeable on tergite (2 + 3). Scape, pedicel and more basal flagellar segments more or less honey-brown; flagellum broken but with 42 dark segments present. Front and middle coxae honey-brown; hind femora infuscated but paler at base; hind tibiae honey-yellow; hind tarsus brownish. Wings rather strongly brownish; stigma dark brown but paler at base.

Head narrower behind the eyes than across them, more rounded behind the eyes and less narrowed to the occiput than in *melpomene* (fig. 120). Face transversely striate, the striation somewhat confluent but more or less obliterated along the middle line. Frons and vertex with strong, transverse striation which on the whole is fairly regular, even to sides of the ocelli. Lamella of the clypeus well developed. Eyes less bulging than in *melpomene*, appearing smaller but their longer axis, as in *melpomene*, 3 times the length of the malar space. Antenna: flagellum 1 nearly 1½ times as long as scape plus pedicel, 10 : 7; hairs of the flagellum closely recumbent and at least on the four basal segments clearly shorter than the width of the segments. Ocelli nearly in an equilateral triangle; hardly a trace of a furrow around them.

Thorax: Pronotal keel extremely weak, hardly developed, medially more or less contiguous with the posterior margin of the pronotum; lateral area sharply delimited, smooth on at least posterior half. Mesonotum falling perpendicularly to the pronotum, its lobes less clearly defined as separate convexities than in the species of the *melpomene*-complex; strong shining rugosities cover the whole of the mesonotum, their density much as in *melpomene* (cf. fig. 112); but they are more confused; they leave free a linear band of surface sculpture on each lateral lobe and on middle lobe an ill-defined linear band of surface sculpture on each side of the middle line; posterior ridges moderately well defined; hairs rather numerous, tending to curve inwards. Scutellum very feebly convex, scaly-reticulate but also with a few inequalities of surface; its anterior depression with three strong costae. Propodeum: basal carina one-third to one-half as long as its forks; all propodeal areas, except spiracular areas which show a number of rugae, virtually smooth and highly polished; the ridge between the areola and the area petiolaris is unusually strong, and the latter area falls away very sharply from the former. Mesopleural furrow closely costate; disc smooth, polished. Legs: hind coxa with a prominent projection and strongly striated above; longer hairs of the upper surface of the hind tibia rather short, only a little longer than the middle width of the tibia; apical lobe without spines; hind tarsus 1 less than twice 2, 5 : 3; 3 a trifle longer than 5, 12 : 11. Recurrens received into 2nd cubital cell by a distance equal to nearly one-half its own length.

Abdomen: Petiole twice as long as the propodeum; from spiracles to the apical dilatation with more or less transverse, shining rugosity. Ovipositor sheaths clearly longer than the whole body, 7 : 5.

Length: about 5 mm.; ovipositor 7 mm.

S. INDIA: Madras, Kodaikanal, Shembaganur, 6000 ft., 30.iii.1936, 1 ♀; (Brit. Mus.—Ceylon Mus. Exped. to S. India, 1936); Nelliampathi Hills, Top Slip Camp, 26.iv.1937, 1 ♀, the type (Brit. Mus.—Ceylon Mus. Exped. to S. India, April–May, 1937).

Type in British Museum (Natural History).

This is a handsome and distinctive species and can at once be separated from the other members of the group with equally rugose mesonotum by the coal-black colour of this sclerite. The equally coal-black propodeum with its smooth, highly polished fields is also a characteristic feature of the species.

Spathius medon sp. n.

This species, though differing from *dido* strikingly in colour, is remarkably like it in other respects. It may be compared with that species as follows :—

♀. Apart from the propodeum and metapleura, which are black or nearly so, thorax entirely reddish; petiole reddish; gaster paler, especially towards the base. Flagellum in one female (Ceylon) with about seven dingy yellow preapical segments; in the 2nd female (Kodaikanal) which has the flagellum complete, all the segments are dark. Legs paler; hind femora not obviously infuscated.

Striation of the face considerably weaker. Frons and vertex appearing a little more finely striate, but this may be an illusion due to the smaller size of the head, the species being a good deal smaller than *dido*. Antenna with 40 and 42 segments (2 ♀♀); vestiture of the flagellum a trifle longer.

Raised rugosities of the mesonotum less smooth in appearance; the middle lobe more sharply defined, its lateral margin being almost carinate; this carina, which is made up of short, often incomplete connections between the transverse rugosities at the point where these slope down into the notaulices, appears faintly blackened in a dorsal view; lateral lobes with a slightly larger zone of ground sculpture and this zone of more blurred outline. Areas of the propodeum not quite so conspicuously polished as in *dido*. Recurrens received into the 2nd cubital cell nearer the transverse cubitus; at a distance equal to hardly one-third its own length.

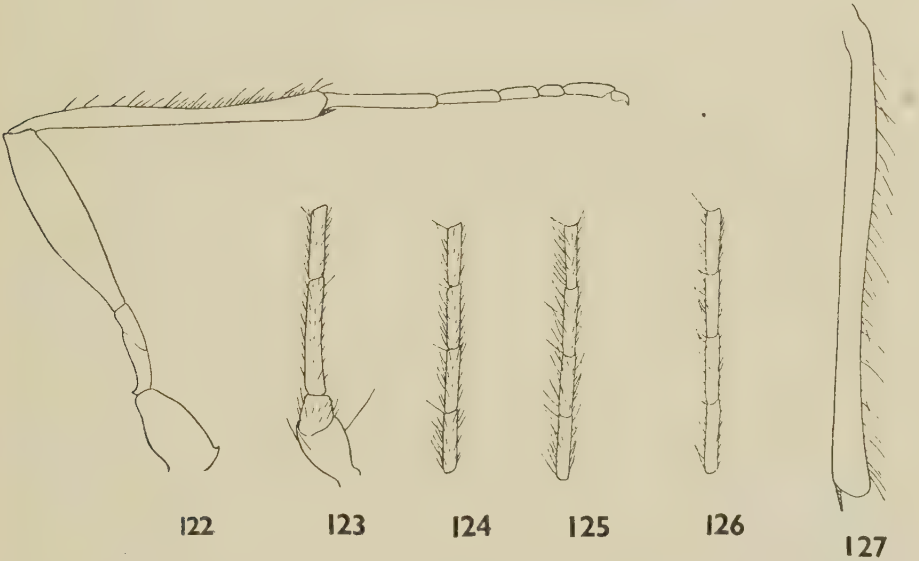
Length: 3·5 mm. without ovipositor.

S. INDIA: Madras, Nilambur, Chatambarai, 6.v.1924, 1 ♀ (*S. K. Pillai*);

Kodaikanal (this is spelt Kadaj Kanal on the label), 1 ♀ (*T. N. Campbell*). Ceylon: Weligama, 16.i.1908, 1 ♀, the type (*T. B. Fletcher*).

Type in British Museum (Natural History).

This species is certainly very close to *dido* and were it not that the localities overlap, I should not have ruled out the possibility of their being geographical forms of the same species. There is of course no possibility of confusion between the two forms as far as the material I have studied permits me to pass an opinion. The differences in the sculpture of the mesonotum are subtle and perhaps to some extent may be illusory and attributable to the difference in the colour of the background. And again, the difference in the venation is slight and may have little specific value; more material would decide this point.



Figs. 122–127.—122. *Spathius alipes* Wilkinson, hind leg, ♀; 123. *S. bruesi* Wilkinson, 4 basal segments of antenna; 124. *S. enippe* sp. n., segments 9–12 of flagellum; 125. *S. alipes* Wilkinson, segments 9–12 of flagellum; 126. *S. alipes* Wilkinson, subsp. *kokodaensis* subsp. n., segments 9–12 of flagellum; 127. *S. bruesioides* sp. n., hind tibia, ♀.

Spathius bruesi Wilkinson.

Spathius striaticeps Brues *nec* Cameron, 1924, *Ann. S. Afr. Mus.* **19** : 11.
Spathius bruesi Wilkinson, 1931, *Trans. ent. Soc. Lond.* **79** : 514.

♀. A dark brown species to the naked eye. Head brown with the vertex frequently blackened but pale along the eye-margin; when the vertex is less blackened, the pale margin around the eye is hardly noticeable; thorax more or less black, rarely the sides of the pronotum and middle part of the mesopleura piceous; gaster varying from brown to nearly black but the extreme base of tergite (2 + 3) with a pale transverse suffusion. Scape and pedicel brown, darker than the 1st segment of the flagellum, which segment is somewhat yellowish; flagellum without pale segments at apex. Front and middle coxae more or less honey-brown, sometimes paler, sometimes darker; hind coxae always decidedly brown; hind femora brown, faintly paler at extreme base; hind tibiae honey-yellow to honey-brown, very faintly darker towards apex. Wings brownish; stigma brown, faintly paler at extreme base. Two basal segments of both palpi faintly darker than the rest, which are more or less honey-yellow.

Head transverse, a little narrower behind the eyes than across them (figs. 114 & 116). Face with shining, subconfluent striation, which is interrupted along the middle line where a weak elevation occurs. Frons with sharp smooth striation. Vertex with rather weak, uneven striation obliterated along the middle line and fading out long before the eye-margin; in one rather small female from Katberg the striation is hardly visible. Antenna with 36–39 segments (4 ♀♀); flagellum 1 a little longer than scape plus pedicel, 15 : 13, and 1½ times as long as 2; flagellar hairs fine, inconspicuous, shorter than the width of the segments, at least on the four basal segments (fig. 123). Ocelli in a triangle whose base is clearly a little longer than its sides. Malar space equal to half the longer axis of the eye. Clypeus with a well-defined membranous rim.

Thorax: Pronotal keel very indistinct, medially almost obliterated; lateral area fairly well delimited, transversely ribbed. Mesonotum falling almost perpendicularly to the pronotum, its hairs long, rather numerous but absent from the middle part of the lobes; lobes on the whole finely sculptured; sometimes, in largest individuals, the rugae of the notaulices spread on to the lateral lobes, and the posterior part of the middle lobe posterior to about the middle point of the mesonotum, shows strong transverse rugae. Scutellum hardly convex, smooth or with traces of ground sculpture, its anterior depression divided into four smooth foveae but sometimes the two lateral ridges weak. Propodeum presenting a very rugose appearance; basal carina from two-thirds to as long as its forks; areola and area petiolaris separated by a clearly emphasised and sometimes strong ridge; dorsal areas with only a very few long hairs posteriorly; all the areas with a certain amount of raised rugosity but the dorsal areas nearly smooth on anterior half. Hairs of the upper surface of the hind tibia very long, about 2½ times as long as the middle width of the tibia; in a lateral view of this tibia, there are virtually no short hairs mixed with the long hairs; apical lobe without spines; hind tarsus 1 a little less than twice 2, 24 : 13; 3 as long as 5. Wings: the proportion of the 2nd abscissa of the radius to the third is somewhat variable, but is usually about half as long; in two females from Katberg it is decidedly more than half, about 30 : 53; 1st and 2nd abscissae of the radius sometimes more or less in a straight line, sometimes decidedly not; recurrens received into the 2nd cubital cell at a distance equal to from one-third to one-half. Mesopleural furrow closely costate; sometimes rugose-costate along lower side; disc not quite smooth.

Abdomen: Petiole about 1½ times as long as the propodeum and, except within the apical dilatation, closely reticulate-rugose. Ovipositor sheaths as long as the body.

Length: 3·5–4·2 mm. without ovipositor.

♂. Like the female but smaller. Gaster frequently with a bilobed yellowish patch. Subcostella beyond apex of mediellan cell a little dilated.

AFRICA: Cape Province, Swellendam, ii.1932, 2 ♀♀ (both have smooth vertex); E. Cape Province, Katberg, 4000 ft., xii.1932–ii.1933, 3 ♀♀, 8 ♂♂; Pondoland, Port St. John, iii.–iv.1924, 4 ♀♀, 1 ♂ with smooth vertex (*R. E. Turner*); Zululand, M'fongosi, iv.1916, *Type locality*.

I do not know the type of this species but feel confident of having interpreted it correctly from Brues's description.

Important for the recognition of *Spathius bruesi*, at least as far as the female is concerned, are the proportions of the first four antennal segments, presence of striation, however weak, on vertex and the long hairs of the hind tibia. And, in order to separate it from the next species, the outline of the infraclypeal opening.

Spathius opis sp. n.

Differs from *bruesi*, to which it is extremely closely related, as follows:—

♀. Colour of the head on the whole more diffuse, there being less of a contrast between the dark vertex and the paler face. Hind tibia more or less honey-brown.

Vertex completely smooth. Antenna with 31 segments (1 ♀); flagellum 1 shorter, as long as scape plus pedicel and varying from 1¼ to 1½ times as long as f. 2. Tentorial pits smaller, hardly noticeable and more widely separated from the upper basal angle of the mandible. Outline of the infraclypeal opening along the clypeus more curved and laterally a little sinuate (fig. 117). Clypeus virtually without a membranous rim.

Propodeum presenting a more rugose appearance; areola and area petiolaris frequently confluent, in which case the elongate area thus formed transversely but irregularly ribbed. Hairs of the upper surface of the hind tibia more erect. 1st and 2nd abscissae of the radius decidedly not in a straight line.

Ovipositor sheaths shorter than the abdomen, 7 : 9.

Length: 3–4 mm. without ovipositor.

♂. I have placed two males along with these females; both have the areola and area petiolaris confluent.

Africa: Zululand, Gingindhlovu, 5.vii.1926, 1 ♀, 1 ♂; Zululand, Umhlatuzi R., 6.vi.1926, 1 ♂, 1 ♀. Cape Province, Pondoland, Port St. John, 1.vi.1923, 1 ♀; Transkei, Umtata, ii.–iii.1923, 1 ♀. Natal, Kloof, 1500 ft., ix.1926, 2 ♀♀, one the *type* (both very dark in colour) (*R. E. Turner*). Uganda, Ruwenzori Range, Kilembe, 4500 ft., xii.1934–i.1935, 1 ♀ (this female has the head very pale brown and a dull reddish suffusion within the posterior depression of the mesonotum; the face is almost smooth) (*F. W. Edwards*).

Type in British Museum (Natural History).

It should be emphasised that all the above females possess the two salient features of *bruesi*, namely, small eyes and very long tibial hairs. Undoubtedly the most reliable character for separating the two species is the dorsal outline of the infraclypeal cavity.

Spathius opis subsp. **rufovariegatus** subsp. n.

♀. Thorax considerably marked with red; in two out of five females the entire thorax, except dorsal surface of propodeum which is darkened, dull red; in two of the remaining females, the lobes of the mesonotum are darkened and only the posterior depression remains reddish while the mesopleura is infuscate over its medial surface; the fifth female is intermediate between the two extreme forms, the mesonotum being only faintly darkened and the mesopleura being clear reddish; in the three palest females, the head is evenly yellowish-red but in the two darker specimens it is almost brownish but paler around the eye-margins.

The vertex varies from being finely striate to more or less smooth. Eyes a trifle larger. Antenna with 28–31 segments (4 ♀♀); flagellum 1 about 1¼ times as long as 2. Posterior ridges of the mesonotum sharp and rather irregular. Apical lobe of the hind tibia with 1–2 very inconspicuous spines.

S. India: Madras, Kodaikanal (spelt Kadaj Kanal on label), 5 ♀♀, one the type (*T. N. Campbell*).

Type in British Museum (Natural History).

I also refer to *opis* sensu lato, the following specimens :—

(1) Philippines: Luzon, Mt. Makiling, 2 ♀♀. These are hardly different from subsp. *rufovariegatus*; one female has the thorax entirely red, except for the lateral lobes of the mesonotum which are blackened; the second female is like the darker forms of *rufovariegatus*. The mesonotum is more finely sculptured, the rugae which branch off from the posterior ridges being considerably weaker and not encroaching on to the convexity of the lateral lobes. Areola of the propodeum confluent with the area petiolaris in one female but not in the other.

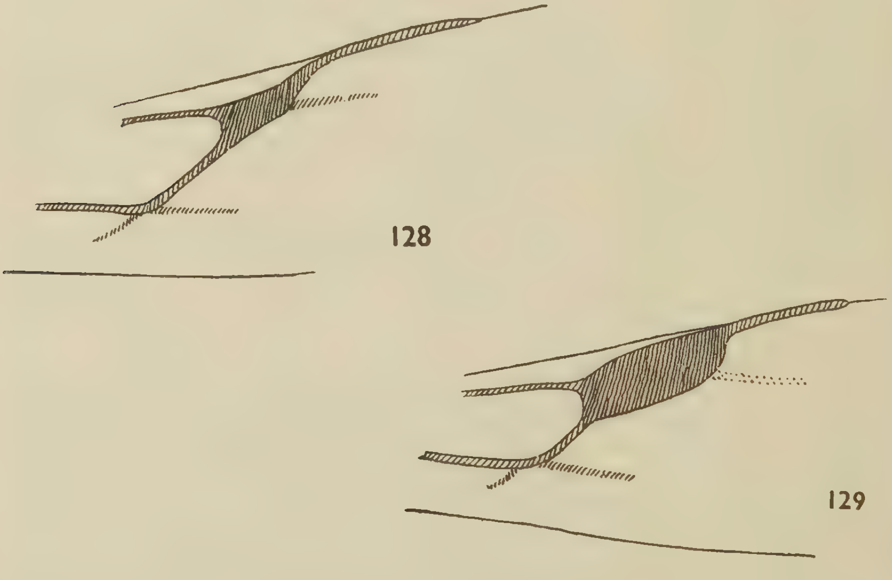
(2) China: Phu Lang Thuong, 1 ♀, size large, 4·5 mm. without the ovipositor, which is a little longer than the whole body. The vertex has only the merest

trace of striation, hardly perceptible. The mesonotum is more rugose than in the two Philippine females and the posterior ridges are decidedly irregular.

The long ovipositor makes this specimen very doubtful.

(3) MALAY ARCHIPELAGO : West Flores, 2 ♀♀, both black to the naked eye; head dark brown; thorax black with only the propleura and that part of the pronotum adjacent to the propleura reddish. Both examples have the face almost smooth. In one female, tergite (2 + 3) shows faint traces of shining, quite indefinite sculpture.

(4) SUDAN : Shambat, 2 ♀♀, 2.xii.1926, ex Berseem (*H. W. Bedford*). One of these two females is of the form *rufovariegatus* but the other is much darker, though the posterior depression of the mesonotum shows a reddish flush.



FIGS. 128–129.—Part of hind-wing :—128. *Spathius bruesioides* sp. n., ♂; 129. *S. erigone* sp. n., ♂.

Spathius bruesioides sp. n.

This species is deceptively like *bruesi* in general facies but differs from it at once in having much shorter tibial hairs (fig. 127). It may be compared with *bruesi* as follows :—

♀. Head pale honey-brown with a dark patch covering most of the frons and vertex but not extending on to the temples; gaster on the whole paler, clearly paler than the thorax and petiole to the naked eye; extreme base of tergite (2 + 3) with a transverse pale patch as in *bruesi*.

Antenna with 38–40 segments (3 ♀♀); flagellum 1 longer in proportion to combined length of scape and pedicel, about 16 : 11.

1st and 2nd abscissae of the radius exactly or almost in a straight line; in any case no trace of an angle as rarely in *bruesi*.

♂. Like the female, except for the usual sexual characters. More or less the whole of tergite (2 + 3) is yellowish. The two smallest examples have the vertex more or less smooth. Subcostella beyond the apex of the mediellan cell more dilated than in male of *bruesi* (fig. 128).

Africa: Natal, Van Reenan, Drakensberg, xi.1926, 2 ♂♂; xii.1926, 3 ♀♀, one the *type*; 1–22.i.1927, 6 ♀♀, 5 ♂♂ (*R. E. Turner*).
Type in British Museum (Natural History).

Spathius laeviceps Brues.

Spathius laeviceps Brues, 1924, *Ann. S. Afr. Mus.* **19** : 13.

♀. Entirely bright fulvous, the head and gaster perhaps a shade paler than the thorax. Coxae yellowish; legs otherwise much the same colour as the head, except the tarsi—more especially the hind pair—which show a somewhat variable amount of infuscation, less intense at the apex of the segments. Wings brownish; stigma pale yellowish, paler than the rest of the venation. Palpi whitish-yellow throughout.

Head as in *bruesi* in shape (cf. fig. 116). Face, even in largest examples, very shining and more or less without transverse striation; only feeble, ill-defined punctures are present with a trace of transverse rugosity on each side beneath the antennal socket. Frons and vertex entirely smooth. Antenna with 46–49 segments (3 ♀♀); flagellum 1 fully 1½ times as long as scape plus pedicel, 17 : 11; hairs of flagellar segments not longer than the width of the segments and equally short on all of them. Eyes rather small, 2½ times as long as the malar space. Ocelli in an equilateral triangle. Clypeus with a prominent lamelliform rim.

Thorax: Pronotal keel very feebly defined medially, sometimes not resolvable; lateral area clearly delimited, transversely ribbed. Mesonotum falling more or less perpendicularly to the pronotum; its lobes almost everywhere with a fine, scaly-reticulation; posterior ridges well defined and in most cases even. Scutellum hardly convex, shining and with traces of scaly-reticulation; its anterior depression with 3 strong costae dividing it into four foveae. Propodeum: basal carina one-third to one-half as long as its forks; ridge separating areola from the area petiolaris sometimes rather feeble, occasionally absent. Mesopleural furrow rather shallow, especially anteriorly and here rather finely and confusedly rugose; disc smooth. Legs: upper surface of the hind tibia with long and short hairs mixed but the longest of them only a trifle longer than the middle width of the tibia; apical lobe without spines; segment 3 of the hind tarsus a trifle longer than 5, 11 : 10. Recurrens of the fore-wing received into the 2nd cubital cell at a distance equal to nearly one-half its own length.

Abdomen: Petiole twice as long as the propodeum, evenly and rather finely reticulate-rugose and virtually without longitudinal elements. Ovipositor sheaths longer than the whole body, about 11 : 9.

Length: 4·5–5·5 mm. without ovipositor.

Africa: Eastern Transvaal, Komati Poort, xi.1918 (*R. W. Tucker*), described by Brues from one female. Cape Province, Pondoland, Port St. John, 12 ♀♀, iii.–iv.1924 (*R. E. Turner*). Zululand, Eshowe, vi.1926, 2 ♀♀; Gingindhlovu, vi.1926, 2 ♀♀ (*R. E. Turner*). Natal, Kloof, 1500 ft., ix.1926, 2 ♀♀ (*R. E. Turner*).
Type presumably in the South African Museum.
Structurally there is nothing characteristic about this species but it is at once distinguished from all the other members of the group by its colour.

Spathius transversalis Szepligeti.

Spathius transversalis Szepligeti, 1914, *Mitt. zool. Mus. Berl.* **7** : 193.

I have examined a female, received from the Zoological Museum, Berlin, with the locality which is first recorded by Szepligeti in his description of this species. The specimen also bears a label in Szepligeti's own handwriting "Sp. transversus"—the name "*transversus*" may have been changed afterwards to "*transversalis*" or thus written in error. Anyway, I have accepted this female as representing Szepligeti's species and have also been inclined to regard it, if not as type, then certainly as a paratype.

If I am right in associating with it a certain number of individuals, and I have taken this step because intergrades exist in the material I have studied, then the Berlin female is a small and not characteristic individual of the species. The following description is hence based upon my own interpretation of *transversalis*.

A species resembling *laeviceps* in having pale yellow preapical flagellar segments; it differs from *laeviceps* as follows :—

♀. Virtually black to the naked eye; the head is very dark brown; gaster a little paler than the head, its tip more or less honey-yellow. The hind femora are infuscated except on about basal quarter; tarsi all decidedly infuscate. Stigma dark brown but pale yellowish in Szepligeti's female.

Face with transverse subconfluent striation, feebler along the weak medial elevation. Frons and vertex somewhat dull, closely and rather finely striated, but the latter smooth in the Berlin female. Antenna with 45 segments (1 ♀, the largest); hairs of the flagellum longer; this is more especially noticeable after about the middle of the flagellum, the hairs being dark, bristly, outstanding and clearly longer than the width of the segments. Eyes considerably larger, their longer axis 3½ to 4 times as long as the malar space. Base of the ocellar triangle distinctly longer than its sides.

Ridge separating the areola from the area petiolaris well developed in the five females examined. Mesopleural furrow rather more clearly delimited, but this impression may be illusory and the result of the different colour of the background.

Africa: Uganda, Ruwenzori Range, Kilembe, 4500 ft., xii.1934–i.1935, 1 ♀ (*F. W. Edwards*); Budongo Forest, 7.ii.1935, 3 ♀♀ (*F. W. Edwards*). Belgian Congo, Elizabethville, 11–17.ix.1931, 1 ♀ (*T. D. A. Cockerell*). S.E. Rhodesia, Gazaland, Mt. Chirinda, Melsetter, 1–2.x.1905, 1 ♀ (*G. A. K. Marshall*). N. Nyasaland, Langenburg (*Fülleborn*), the Berlin female discussed above. N. Nigeria, Zungeru, xii.1910, 2 ♀♀ (3·3 mm. without ovipositor; vertex entirely smooth) (*J. W. Scott-Macfie*). B.E. Africa, S.E. Slopes of Kenya, 6000–7000 ft., 3–12.ii.1911, 1 ♀ (vertex with faint traces of striation; 3·3 mm.) (*S. A. Neave*).

Type in Zoological Museum, Berlin.

The combination of large eyes, yellow preapical flagellar segments and, in specimens of average size, closely striate vertex, sums up what is really characteristic about this species. The same combination is, however, possessed by the next species but with a most unusual feature in addition, rendering confusion between the two species improbable.

Spathius tricolor Szepligeti.

Spathius tricolor Szep., 1914, *Mitt. zool. Mus. Berl.* 7 : 193, ♀.
Spathius tricoloratus Wilkinson, 1931, *Trans. ent. Soc. Lond.* 79 : 529.

This characteristic species may be compared with *laeviceps* as follows :—

♀. Head brown, in the type with a faint yellowish flush around the antennal insertions; thorax and petiole black; gaster mostly fulvous brown above but its apex somewhat faintly, and its ventral surface all over, yellowish. Flagellum with at least 13 pale yellow apical segments (type). Legs pale honey-yellow; hind femora very faintly darkened apically, hind tarsal segments a little darkened but not beneath, nor at apex.

Head slightly less transverse and more narrowed towards the occipital margin. Face with extremely feeble transverse striation and with faint traces of scaly-reticulation. Frons and vertex finely striate. Antenna broken but with at least 39 segments; flagellum 1 a little shorter in proportion to scape plus pedicel, about 4 : 3; vestiture of the flagellum longer, bristly, much more conspicuous, like that of *transversalis*. Eyes large, their longer axis 4½ times as long as the malar space. Ocelli in a triangle with base distinctly longer than sides.

Propodeum having a decidedly dull appearance, finely rugulose, and densely clothed all over, *not less densely within the dorsal areas*, with long pale brownish pubescence; the ridge separating the areola from the area petiolaris is prominently raised and in profile shows as a conspicuous dentiform projection. Mesopleural furrow deep, evenly costate; disc with faint traces of scaly-reticulation. Hind tarsal segment 3 distinctly shorter than 5, 7 : 9.

Petiole decidedly smooth-looking, its sculpture, in which there is hardly a trace of longitudinal elements, almost obliterated. Ovipositor sheaths distinctly a little shorter than the whole body.

Length: 4·3 mm. without ovipositor, type; 3·5 mm. paratype.

W. Africa: Togo, Bismarckburg, 3–10.xii.1892, 2 ♀♀ (*L. Conradt*). This is the type locality; one of the females bears Szepligeti's label "Sp. tricolor m." and I have accepted it as the type of the species.

Type in Zoological Museum, Berlin.

♂. I have before me a single example (Uganda, Masaka, *F. W. Edwards*) which may be the male of this species. The head and gaster are entirely dark brown; propleura and pronotum posterior and dorsal to the lateral depression, pale honey-yellow. Antenna with 41 segments, the flagellum dark throughout. Pubescence of the propodeum a little less thick than in the female; ridge separating areola from the area petiolaris less prominent. Petiole less feebly sculptured, bearing distinct though fine longitudinal striations. Subcostella beyond the apex of the mediellan cell markedly thickened.

On colour alone, I should be much more inclined to regard this single example as the male of *transversalis* Szepligeti though the pale pronotum and propleura do not occur in that species; nor, for that matter, in *tricolor*. The pubescence of the propodeum is likely to prove, however, a far more decisive character in suggesting the right place of this male than is colour alone, and provisionally at least, I think it should be regarded as the probable male of *tricolor*.

Spathius tricolor Szepligeti is essentially characterised by the pubescence of the propodeum. Although I have compared it for convenience with *laeviceps*, it is much more closely allied, I think, to *transversalis*, having in common with that species such important features as (1) large eyes and (2) long flagellar vestiture.

Spathius thyas sp. n.

Here is a species which differs chiefly from *transversalis* in having the head entirely fulvous. Were it not that all the material was taken on the same day and in the same place as many of the examples of the latter species and that no intergrades occur, I should be strongly inclined to regard these pale-headed specimens as merely a form of *transversalis*. Other points of difference are:—

Propleura entirely fulvous like the head; gaster yellowish or yellowish-red at apex above and over about apical half beneath; in well-preserved specimens the brown of tergite

(2 + 3) extends over the epipleura of this segment and on the ventral surface of the gaster shows as a fairly sharply discrete brown patch on each side. Hind femora faintly darkened above at apex but otherwise fulvous.

Eyes a little smaller; hairs of the flagellum a trifle shorter. Vestiture of the upper surface of the hind tibia showing a greater contrast of long and short hairs.

The two smallest females, about 3 mm. without ovipositor, have the vertex entirely smooth.

Africa: Uganda, Budongo Forest, 7.ii.1935, 7 ♀♀, one the type (*F. W. Edwards*).

Type in British Museum.

Spathius caudatus Szepligeti.

Spathius caudatus Szepligeti, 1913, *Ann. Mus. Nat. Hungarici* **11** : 599.

Under this name I group a number of individuals whose affinities have caused me many misgivings. Except in colour, where the difference is striking and absolute, they show a great resemblance to *laeviceps* Brues, having in common with that species the vertex entirely smooth. Further differences from *laeviceps* are as follows :—

♀. Head fulvous with a dark patch covering most of the frons and the vertex; thorax and petiole black, except for the propleura which is reddish; gaster dark brown. Hind femora brownish except at base. Palpi faintly darkened on at least the two basal segments. Flagellum without yellow preapical segments. Stigma dark brown, except at extreme base.

Face with decidedly obsolescent striation interspersed with rather large, but very ill-defined punctures. Antenna with 43 segments (1 ♀); pubescence of flagellum a trifle longer. Eyes a little larger, their longer axis 2½ times as long as the malar space. Mesopleural furrow deeper, more evenly costate, exactly like that of *thyas* and *transversalis*.

Length: 4·2–4·8 mm. without ovipositor.

Africa: Tanganyika Territory, Mtoachimu, 19.i.1906, 1 ♀, the type (*Schröder*); Kihuiro, 15.i.1906, 1 ♀ (*Schröder*); Amani, xii.1906, 1 ♀ (*Schröder*). These three specimens were named as *caudatus* by Szepligeti and recorded by him as such.

Type in Zoological Museum, Berlin.

I also refer to this species three females—the largest of which is 5·5 mm., the smallest 3·5 mm.—from the Belgian Congo, Elizabethville, 11–17.ix.1931 (*A. Mackie*); these three females differ greatly in colour from the nominotypical form : the top of the head shows the characteristic dark patch though it is much reduced in extent in the largest female and hardly extends on to the vertex ; the gaster is markedly pale, the entire ventral surface being yellowish, and, on the dorsal surface, tergite (2 + 3) is extensively brownish in the largest female ; in this same female the pronotum, mesopleura and mesosternum are dull reddish ; in the two smaller females these parts are much more brightly reddish and in one of them the pale colour embraces the entire propodeum. The stigma is paler than in the nominotypical form and is more or less yellowish all along the outer edge.

From small examples of *thyas* with smooth vertex, *caudatus* would be distinguished by having no pale flagellar segments, and from small individuals of *transversalis* with smooth vertex, by smaller eyes in addition to the lack of yellow preapical flagellar segments.

Group of **pelides** sp. n.

Vertex strongly sculptured. Antennal scape rather long; flagellum with at least 5 yellowish apical segments. Oral carina well developed and prominent (fig. 137).

Pronotal keel indistinct but fused medially with the posterior margin of the pronotum. Mesonotum in greater part with coarse raised rugosities; on the lateral lobes only a narrow longitudinal area of fine ground sculpture is left free. Basal carina of the propodeum long, fully as long as its forks; areola and area petiolaris confluent. Mesopleura sculptured over most of its surface; the costae of the furrow extending much beyond its limits. Recurrens of the fore-wing received into the 2nd cubital cell at a distance from the 1st intercubitus equal to about one-quarter of its own length (of recurrens). Hind coxa with a well-developed basal projection; hind tarsus 1 a trifle more than twice 2; 3 two-thirds of 5; lobe of the hind tibia with one spine.

Petiole about 1½ times as long as the propodeum. Tergite (2 + 3) with a sharp and completely differentiated margin from base to apex; epipleura of tergite 3 also sharply deflexed but without a differentiated lateral margin.

BORNEO; PHILIPPINES. Two species.

Of all the above characteristics the most important is the margined sides of tergite (2 + 3) and in this respect alone is, I think, to be found the justification for treating the two following species as members of a distinct group.

Spathius pelides sp. n.

♀. Head and thorax red-brown; petiole almost black with an extremely faint reddish tint; dorsal surface of the gaster dark shining brown, becoming yellowish along sides of tergite (2 + 3) and rather extensively so in the apical corners of this segment, the pale areas joining as a faint band along the apical margin of the segment; sides of tergites 4–6 also paler; 7 and 8 entirely pale; ventral surface pale brownish-yellow throughout. Flagellum dark brown, its apical 10–11 segments (the apical segment being excluded), yellow. All the coxae honey-yellow, the hind pair with a faint brownish tint; except that the apical tarsal segment of all legs is a little darkened, the legs are virtually honey-yellow throughout. Palpi whitish-yellow. Wings faintly and evenly brownish; stigma almost yellowish-brown, only very faintly paler at base and apex.

Head strongly transverse, much narrower behind the eyes than across them (fig. 138). Face with strong, shining, slightly wrinkly, transverse striation, interrupted along the middle line, on upper half, by a shining keel-like elevation. Clypeus a little swollen. Frons with strong striation which becomes much wrinkled towards the eyes, the margin of which it reaches. Vertex with strong, transverse striation; that on anterior half is the most regular and laterally curves forward between ocelli and eye; on posterior half the ridges become somewhat confluent and wrinkled; on the temples a number of short ridges are placed more or less at right angles to the occipital margin. Postgenae with a few branching keels running more or less parallel to the occipital margin. Oral margin unusually strongly developed and, in a lateral view, almost angled in the middle (fig. 137). Antenna 48-segmented; flagellum 1 a trifle shorter than scape plus pedicel, 7 : 8; hairs of the flagellum recumbent and on at least the four basal segments, shorter than the width of the segments. Base of the ocellar triangle only very slightly longer than its sides.

Thorax: Pronotal keel widely fused medially with the posterior margin of the pronotum; lateral area fairly well defined, evenly ribbed. Mesonotum sloping rather gradually to the pronotum; its hairs rather numerous but only semi-erect and absent on the greater medial surface of the lobes; the notaulices are virtually not indicated; the whole of the mesonotum is covered with very strong, very irregular, shining rugosities which, on lateral lobes, leave free a raised linear area covered with fine ground sculpture; on either side of the middle line of the middle lobe is a feeble furrow, the course of which is to some extent emphasised by having traces of ground sculpture; posterior ridges indicated but not conspicuous. Scutellum more or less discrete, being almost circular, its lateral margin, on anterior half, being raised above, and separated by a furrow from, the true lateral margin; its surface shining, and with obsolescent rugosities; anterior depression without complete costae but with shortened, thickened rugae, which, at least laterally, fail to reach the anterior margin. Propodeum: dorsal areas with thick, shining reticulate-rugosities all over; lateral, bounding carina of the dorsal areas thickened and strongly bent inwards (fig. 136); the confluent areola and area petiolaris transversely ribbed throughout; posterior protuberances hardly indicated. Metapleura having a somewhat flattened appearance, covered with close and, on the whole, transverse rugae. Mesopleura: the costae of the furrow extend upwards beyond the limits of the furrow on to the disc in the form of thick, shining rugae; similar rugae occur within the subalar impression and they cover, more or less, the upper half of the mesopleura so that on the disc only a relatively small smooth space is left free. Hind femur rather short, abruptly narrowed at base; hind tibia somewhat thick, the hairs of its upper surface set at about 60 degrees and about one and one-quarter times as long as the middle width of the tibia; fringe 2–3. 1st and 2nd abscissae of the radius of the fore-wing almost in a straight line; nervus parallelus arising from just above middle.

Abdomen: Petiole strigose all over, the strigae a little confluent at about middle. Tergites 4–6 finely, closely punctate over basal half; the punctured area of tergites 5 and 6 is covered by the integument of the preceding tergite but the punctation shows through quite clearly. Ovipositor sheaths about as long as the abdomen plus propodeum.

Length: 4·8 mm. without ovipositor.

BORNEO: Sandakan, 1 ♀ (*Baker*).

Type in U.S. National Museum.

This is an interesting species and seems to be largely characterised by the prominent oral margin, colour, areation of the propodeum and punctation of abdominal tergites 4–6.

Spathius lucullus sp. n.

This species differs at once from *pelides* sp. n. in being much smaller (2·8–3 mm. without ovipositor) and in having the ovipositor sheaths shorter than the gaster. It differs from *pelides* as follows:—

♀. Head and thorax unicolorous but with a more yellowish tint; petiole reddish-yellow but darkened in about apical third and also on ventral surface; tergite (2 + 3) brown; narrowly at sides from base to middle, apical corners extensively and a narrow apical band, pale brownish-yellow; rest of the gaster virtually pale brownish-yellow in paratype but in type with a faint brownish suffusion in the middle. The two apical segments of the flagellum dark, the 5–6 segments preceding them pale yellow. Stigma paler, obscurely yellowish.

Sculpture of the frons and vertex much more regular, smooth looking and tending to circumscribe the ocelli. Oral margin a little less prominent. Eyes slightly larger; this is evident more especially in a dorsal view of the head. Antenna with 33 segments (2 ♀♀); flagellum a little more slender, its hairs a little longer and more conspicuous.

Mesonotum similarly sculptured but in the two females studied no indication of a furrow on each side of the middle line. Scutellar shield not emphasised in outline as in *pelides* but the anterior depression presenting a more definite sculpture pattern; two large foveae are present, separated by a single ridge and in each of them is a single abbreviated costa which does not reach the anterior margin. Basal carina of the propodeum a trifle longer than its forks; dorsal areas less rugose; lateral bounding carina of the dorsal areas virtually straight. Sculpture of the mesopleura less regular.

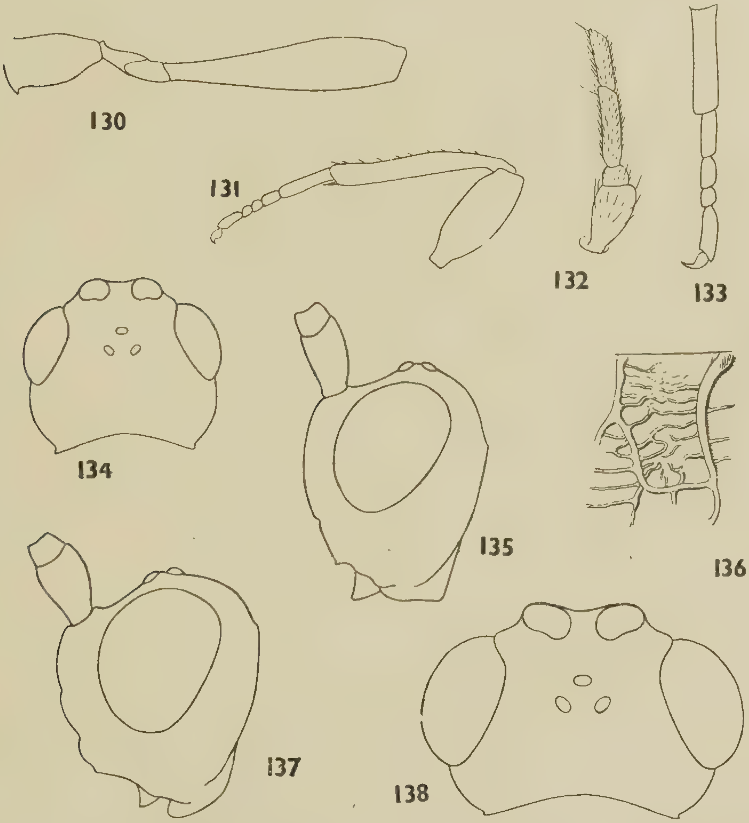
Tergites 4–6 without distinct punctation; in the type, the base of tergite 5 shows the merest trace of it at a magnification of × 60.

PHILIPPINES: Island of Basilan, 2 ♀♀, type and paratype (*Baker*).
Type in U.S. National Museum.

Group of **aristaeus** sp. n.

Spathius aristaeus sp. n.

♀. A slender, black species to the naked eye. Head, thorax and petiole coal-black, very shining; gaster very dark brown above but yellowish over a considerable part of its ventral surface. Antennae brown throughout. Hind coxae, hind femora and hind tarsi (to a less extent also the four other tarsi), brown; hind tibiae dark at extreme base; then with a post-basal pale band and then with a broader, though rather faint, dark band, sometimes very poorly indicated; legs otherwise more or less honey-yellow. Palpi whitish-yellow throughout.



FIGS. 130–138.—130. *Spathius apidanus* sp. n., part of hind leg, ♀; 131. *S. psammathe* sp. n., hind leg, ♀; 132. *S. capaneus* sp. n., 4 basal segments of antenna; 133. *S. capaneus*, hind tarsus, ♀; 134. *S. capys* sp. n., head, dorsal; 135. *S. aristaeus* sp. n., head, lateral; 136. *S. pelides* sp. n., dorsal area of propodeum; 137. *S. pelides*, head, lateral; 138. *S. pelides*, head, dorsal.

Head strongly transverse, considerably narrower behind the eyes than across them but not much narrowed towards the occipital margin. Face very coarsely and very strongly rugose-reticulate, without an obvious transverse tendency; beneath the antennal insertions is a smooth keel. Frons completely smooth, except that against the eye-margin there may be a few feeble punctures. Vertex smooth, except for a few small punctures from which the scattered hairs arise. Cheeks as far as the temples with strong sculpture similar to that of the face but with well-marked longitudinal elements. Base of the ocellar triangle only very slightly longer than its sides. Antenna with 46 segments (1 ♀); flagellum 1 a little longer than scape plus pedicel, 17 : 15; hairs of at least the four basal flagellar segments inconspicuous, semi-erect, considerably shorter than the width of the segments. Oral margin very strongly raised and, posterior to middle, more or less right angled in profile (fig. 135). Occipital margin widely obliterated above.

Thorax: Pronotal keel very feeble, distinct only on the collar, but widely separated from the posterior margin of the pronotum; lateral area completely, or almost completely, smooth, the polished surface merging, uninterrupted by any rugosity, into the equally highly polished and smooth surface of the pronotal collar. Mesonotum strongly shining and, by comparison with other species, almost smooth, there being present only shallow foveae and short furrow-like depressions, all very vague in outline; on middle lobe, on each side of the middle line, there is a narrow tract of dull surface sculpture; when no middle line is indicated, the two areas flow together to form a single moderately large tract; mesonotal hairs long and sparse. Scutellum separated from the mesonotum by a deep cleft, the edges of which are thickened and smooth; disc proper very slightly convex, smooth except for a few large shallow pits; anteriorly prolonged forwards so that the anterior depression is divided into two parts; but each of these parts is not in the form of a delimited fovea as might be expected, the surface merely showing deep irregularities. Propodeum elongate; basal carina one and one-half times to twice as long as its forks; areola separated from the area petiolaris by a thickened ridge; dorsal areas longer than basally wide; spiracular areas, areola and a small area on each side of the areola finely pubescent; no trace of posterior protuberances. Disc of the mesopleura with obsolescent sulcation and rugosity but medially becoming more or less smooth. Legs: hind coxa with a transverse keel beneath at base; in profile this keel shows as a dentiform projection; upper surface of the hind coxa deeply fluted; hind femur rather stout; hairs of the upper surface of the hind tibia about one and one-third times as long as the middle width of the tibia; apical lobe with 2–3 spines; hind tarsus 1 a little more than twice 2, 28 : 13, 3 two-thirds of 5. Fore-wing: a well-defined angle between the 1st and 2nd abscissae of the radius; recurrens received into the 2nd cubital cell at a distance from the 1st intercubitus equal to about one-quarter its own length; nervus parallelus arising from middle or just above.

Abdomen: Petiole very long, about two and one-quarter times as long as the propodeum, almost smooth, only a few obsolescent ridges being present towards the apex. Tergite (2 + 3) sharply margined laterally from base to apex; the margin completely differentiated; further, tergite (2 + 3) is as long as apically wide; the epipleura of tergite 4 is also fairly sharply deflexed but no differentiated margin is present; tergite 4 is minutely punctate across the basal half; tergites 5 and 6 also minutely punctate at base, but as these segments are usually retracted, the punctate zone is not readily visible. Ovipositor sheaths about as long as the gaster plus petiole.

Length: 5·8–6 mm. without ovipositor.

PHILIPPINES: Mindanao, Butuan, 1 ♀, the type; Iligan, 1 ♀; Surigao, 1 ♀, Zamboanga, 2 ♀♀ (one of these females from Zamboanga is small, 4 mm. without ovipositor and paler in colour than typical exs.) (all Coll. *Baker*).

Type in U.S. National Museum.

This very distinctive and interesting species appears to be related only to *S. philodemus* sp. n. It has certain unusual characters in common with the *pelides* group, such as strongly developed oral carina and margined tergite (2 + 3), but in other respects it is widely different.

Colour and the reduction of sculpture on pro- and mesonotum alone render it a striking species.

Group of **philodemus** sp. n.

Spathius philodemus sp. n.

♀. A very dark, almost blackish species to the naked eye; head black above, but becoming somewhat brownish below; thorax black, except that the anterior $\frac{2}{3}$ of the pronotum is reddish; petiole reddish-brown, the gaster dark brown. Scape and pedicel honey-yellow; flagellum brown throughout. Front and middle legs, as far as the tarsi, which are somewhat darkened, honey-yellow; hind coxae and hind femora dark brown throughout; hind tibiae more or less honey-yellow but faintly darkened at middle above. Wings faintly yellowish; stigma unicolorous, yellowish-brown.

Head decidedly transverse, considerably narrower behind the eyes than across them. Face with coarse shining rugose-reticulation everywhere. Frons strongly shining, with traces of obsolescent rugosity. Vertex on rather more than middle third with coarse transverse sulcation; between this and the ocelli almost smooth; between the ocelli and the eye-margin with traces of obsolescent foveae and puncture-like impressions. Eyes rather large. Ocelli in a triangle with base clearly longer than sides. Antenna with 41 segments; flagellum slender; f. 1 a little longer than scape plus pedicel, 8 : 7; scape rather long. Oral margin strongly raised, like that of *aristaeus* sp. n. (cf. fig. 135).

Thorax: Pronotal keel rather feeble but widely separated from the posterior margin; lateral area of the pronotum not delimited; entire side of the pronotum covered with strongly shining, mostly elongate rugosities. Mesonotum sloping rather gradually to the pronotum, its hairs long and sparse; lobes not clearly defined as separate convexities; notaulic courses indicated by a band of coarse shining subreticulate rugosity; greater part of the middle lobe with somewhat dull, rough scaly-reticulation; lateral lobes also in greater part scaly-reticulate, and in addition shallowly impressed along the middle; posterior carinae virtually lost among the surrounding rugosities. Scutellum flat with traces of surface sculpture and vague pit-like impressions. Postscutellum markedly pubescent. Propodeum with the exception of the dorsal areas, quite thickly pubescent, its areation strong and clearly defined; basal carina as long as its forks; areola separated from the area petiolaris; dorsal areas strongly shining, posteriorly with a few complete transverse carinulae. Mesopleural furrow long, narrow, well defined, smooth; disc more or less smooth anteriorly, but posteriorly showing oblique, strong sulcation. Hind coxae rather long, at base beneath with a weak transverse keel, which in profile shows as a fine tooth; hind femur rather stout, somewhat abruptly narrowed at base; hairs of the upper surface of the hind tibia about $1\frac{1}{2}$ times as long as its middle width, more or less erect; apical lobe with 2 feeble spines; hind tarsus 3 about $\frac{2}{3}$ of 5. Wings: recurrens nearly interstitial; nervus parallelus from just above middle.

Abdomen: Petiole very long and narrow, about $2\frac{1}{3}$ times as long as the propodeum, slightly constricted beyond middle and almost smooth at middle. Gaster evenly ovate; tergite (2 + 3) and 4 and to a less extent 5 finely longitudinally striated (fig. 233 shows only the striation of tergite (2 + 3)); tergite (2 + 3) and 4 with a sharply differentiated lateral margin, their epipleura thin, membranous, more or less honey coloured. Ovipositor sheaths a trifle longer than gaster plus petiole.

Length: 5·5 mm. without ovipositor.

BORNEO: Sandakan, 1 ♀ (*Baker*).

Type in U.S. National Museum.

This elegant species appears to be closely related to *aristaeus* sp. n., though it differs strikingly from that insect in having the gaster sculptured. The two species probably form a single group, although I did not at first recognise this. The important points of resemblance are :—(1) the strongly raised oral margin, (2) the feeble pronotal keel and its wide separation from the posterior margin of the pronotum, (3) the cleft between the mesonotum and the scutellum, (4) transverse keel at base of hind coxa, (5) position of the nervus parallelus, (6) long narrow petiole and (7) differentiated margin at side of tergite (2 + 3).

Group of **capaneus** sp. n.

Head not at all or only very slightly narrower behind the eyes than across them. Face reticulate-rugose, without transverse elements. Vertex rather finely and smoothly striate. Scape rather long (fig. 132); flagellum 1 a little shorter than scape plus pedicel; hairs of at least the 3 basal segments of the flagellum inconspicuous, much shorter than the width of the segments.

Pronotal keel poorly or not developed, narrowly fused when present with the posterior margin of the pronotum or almost obliterated here. Mesonotum falling perpendicularly or almost so to the pronotum; middle lobe very prominent, its shoulders strongly convex and arching high above the deeply impressed notaulices; the hairs of the mesonotum are always very short, recumbent or adpressed, sometimes very inconspicuous. Scutellum virtually flat, its anterior impression with a single medial costa. Propodeum somewhat elongate, its posterior declivity not well defined; areation rather feeble to almost wanting; basal carina present, long, rather fine, reaching to at least one-third; area petiolaris well defined always, its upper limiting keel well developed. Mesopleural furrow closely costate or rugose-costate; disc with traces of surface sculpture. A strong angle between the 1st and 2nd abscissae of the radius; nervus parallelus not interstitial. Legs: hind coxa with a well-defined dentiform projection; upper surface of the hind tibia either without hairs or with very short hairs which are much shorter than the width of the tibia; hind tarsus 3 at most $\frac{2}{3}$ of 5.

Petiole rather long, in profile virtually not swollen in the region of the spiracles, hence not appearing elbowed; a dominant sculpture of rugose-reticulation present.

The above definition, if accepted as it stands, would narrow down the limits of the group considerably. But it must be borne in mind that I have deliberately made it rather full in order to shorten the descriptions of the individual species.

The essential characters of the group appear to be the striate vertex, the details of the mesonotum and the vestiture of the hind tibia.

INDIA. PHILIPPINES. Three species.

Key to the species of the **capaneus** group.—Females.

1. 2nd abscissa of the radius about as long as the 1st intercubitus; 1st intercubitus with a short spur just proximal to middle on stigma side . . . *capaneus* sp. n.
–. 2nd abscissa of the radius considerably longer than the 1st intercubitus; 1st intercubitus without such a spur . . . . 2.
2. Hairs of the hind femur, at least the lateral ones, moderately long and outstanding; hind tibia with short hairs all over its dorsal surface . . . *semele* sp. n.
–. Hairs of the hind femur very short, adpressed; hind tibia bare all over its dorsal surface . . . . *persephone* sp. n.

Spathius capaneus sp. n.

♀. Head and gaster chestnut brown with a dull reddish tint to the naked eye; the head is somewhat yellowish on the face; thorax and petiole very dark brown. Palpi whitish-yellow. All the coxae brownish, the hind pair more obviously so than the others; hind femora brown throughout; hind tibiae whitish on about basal $\frac{2}{5}$, pale brownish at apex; hind tarsi pale yellowish-brown. Scape and pedicel and base of the flagellum pale yellowish-brown.

Head approaching a subcubical condition, hardly narrower behind the eyes than across them. Face dull, evenly and moderately strongly rugose-reticulate all over. Frons rather strongly convex, closely rugose-striate all over; sometimes the transverse striate element not very obvious. Vertex shining, finely and smoothly striated all over. Ocelli situated rather far forward on the vertex, almost in an equilateral triangle. Antenna with 30 segments (2 ♀♀).

Thorax: Pronotal keel not developed; lateral depression not delimited, covered with fine, parallel, close ridges. Mesonotum somewhat dull, falling perpendicularly to the pronotum; middle lobe strongly gibbose in front with prominent convex "shoulders"; its sculpture, as also that of the lateral lobes, consisting of fine, close scaly-reticulation; posterior depression rather deep, finely and intricately rugose, the posterior ridges hardly emphasised; hairs of the mesonotum short, dense, more or less recumbent, evenly distributed but more or less absent along the middle part of the lateral lobes. Scutellum almost flat, shining and more or less smooth in the middle, weakly striated along sides; anterior foveae shallow, their surface rugose. Areola narrow; costulae meeting the bounding keels of the areola at an acute angle; dorsal areas fully 1½ times as long as wide, feebly shining, covered all over with rather fine reticulate-rugosity; no trace of posterior protuberances. Mesopleural furrow wide, rather coarsely rugose-costate; disc shining but showing traces of surface sculpture. Legs short; dentiform projection of the hind coxa rather weak; hind femur thick; hind tibia not at all swollen basally; the hairs of its upper surface much shorter than the middle width of the tibia and a trifle shorter than the hairs on the lower side; apical lobe with a complete row of spines, 6–7; hind tarsus appearing very slightly narrowed from base to apex; this appearance seems to be due chiefly to segment 1 being markedly wider than the others (fig. 133); hind tarsus 1 twice 2, 3 a little more than half of 5, 5 : 9. Wings: 1st and 2nd abscissae of the radius forming almost a right angle; recurrens evected by nearly half (fig. 96).

Abdomen: Petiole a little shorter than the propodeum, with only very weak longitudinal elements except towards apex, parallel-sided, except for the apical dilatation; the spiracles not in the least prominent; gaster, seen from the side, somewhat clavate and more or less rounded at apex. Ovipositor sheaths about as long as the whole body.

Length: 3·5 mm. without ovipositor.

INDIA: Bengal, Sunderbans, 1.iv.1915, 4 ♀♀, one the type, bred from wood of *Heritiera Fomes* (*C. F. C. Beeson*).

Type in British Museum (Natural History).

This species differs from the other members of the group by the venation of the fore-wing, *inter alia*. I know of no other species of *Spathius* which shows a similar spur on the 1st transverse cubitus.

Spathius persephone sp. n.

♀. Medium brown to the naked eye; head and mesonotum somewhat yellowish-brown; lower part of the face and of the cheeks darkened in the paratype, hardly so in type; rest of the thorax a little darker; petiole brown like the darker parts of the thorax; gaster above more yellowish in tint, marked very vaguely with still paler suffusion along the apical margin of the segments; ventral surface yellowish along the middle; the epipleura of tergite (2 + 3) and 4, where their surface is lateral to the gaster, with a large brown patch, widest posteriorly, on tergite (2 + 3) and a smaller one on 4; the outline of these patches is sharply defined where they encroach on to the yellow ventral surface of the gaster. Scape, pedicel and 2–3 basal flagellar segments yellowish. Front and middle coxae pale yellowish; hind coxae brown; hind femora dark brown throughout; front and middle pairs a little paler than the hind pair; hind tibiae whitish-yellow throughout in type, faintly embrowned on about apical quarter in paratype. Wings evenly brownish; stigma slightly paler at extreme base.

Head almost subcubical from above, not at all narrower behind the eyes than across them. Face evenly rugose-reticulate all over, virtually not weaker along the middle line. Frons with close irregular striation which laterally runs more or less parallel to the eye-margin. Vertex with close smooth striation all over; the striation tends to become wrinkled in the paratype near the ocelli. Antenna with 34 segments (paratype). Ocelli situated far forward on the vertex; base of the ocellar triangle a little longer than sides. Occipital margin not clearly defined above in the middle, the striation of the vertex spreading on to the upper part of the occiput itself.

Thorax: Pronotal keel weakly developed; in the middle more or less contiguous narrowly with the posterior margin of the pronotum, though in the type more or less obliterated medially; lateral depression fairly well delimited, shining, crossed by smooth ridges. Mesonotum at first sight bare; its hairs being quite inconspicuous, short, fine, adpressed and distributed around the margins of the lobes; middle lobe falling almost perpendicularly to the pronotum, rather strongly gibbose; sculpture of the lobes on the whole fine, though on lateral convex part of middle lobe and along the inner margin of the lateral lobes there are rather feeble transverse rugulosities; posterior ridges well defined but irregular. Scutellum shining and almost smooth in the middle; the two foveae of the anterior depression large, shallow, ill delimited, their surface covered with irregular rugosities. Basal carina of the propodeum reaching a little more than one-third; areola and posterior limits of the dorsal areas moderately well defined in the type, completely undefined in the paratype; entire dorsal surface of the propodeum covered with close rugose-reticulation and appearing somewhat dull. Mesopleural furrow wide, closely and somewhat irregularly costate; disc covered with fine, somewhat obsolescent and confluent longitudinal striation. Legs: front tarsus as long as its tibia; hind femur rather thick, its hairs very short, adpressed, sparse, almost absent beneath; hind tibia not at all swollen at base, shining and bare along its upper surface; the hairs elsewhere very short, much shorter than the middle width of the tibia; apical lobe with 4 spines; hind tarsus 1, $2\frac{1}{2}$ times as long as 2; 3, $\frac{2}{3}$ of 5. Wings: 1st and 2nd abscissae of the radius forming a well-defined angle *c.* 130°; 2nd abscissa of the radius much longer than the 1st intercubitus.

Abdomen: Petiole about $1\frac{2}{3}$ times as long as the propodeum, longitudinally striate-reticulate. Gaster, seen from the side, somewhat clavate and more or less rounded at apex. Ovipositor sheaths a trifle longer than the whole body.

Length: 6 mm., ovipositor 6·5 mm.

PHILIPPINES: Arorog, Masbate, vii.1917, 1 ♀, the type (*Böttcher*); I. of Basilan, 1 ♀, paratype (*Baker*).

Type in British Museum (Natural History).

Spathius semele sp. n.

This species is very closely related to *persephone*, of which I at first thought it might be only a race. As the differences, however, between it and that species are easily appreciated, I prefer, for the time being, to give *semele* the rank of species. A comparison follows:—

♀. Gaster brownish virtually all over, only very faintly paler beneath; epipleura of tergite (2 + 3) without a sharply delimited brown zone. About apical $\frac{2}{5}$ of the hind tibia darkened.

Head decidedly less cubical seen from above, very slightly narrower behind the eyes than across them. Ocelli placed less far forward on the vertex. Antenna broken.

Hairs of the mesonotum decidedly more conspicuous, longer, more numerous and some of them tending to stand out; they are present all over the surface of the middle lobe; sculpture of the lobes more extensively fine, there being no raised rugulosities on the shoulders of the middle lobe; the lateral lobes are duller and show very faintly indicated punctures, often blurred in outline, impressed on the ground sculpture. Basal carina of the propodeum reaching about one-quarter; areola and dorsal areas clearly delimited but the bounding keels weak and irregular; hairs of the hind femur conspicuous, those towards the lower surface and on lower surface outstanding; upper surface of the hind tibia with outstanding hairs everywhere; they are semi-erect and less than half the middle width of the tibia; apical lobe with 5 spines; hind tarsus a trifle shorter, segment 1 being hardly more than twice 2.

Ovipositor sheaths shorter, as long as the thorax plus abdomen.

PHILIPPINES: Palawan, Puerto Princesa, 1 ♀, the type (*Baker*).
Type in U.S. National Museum.

Group of **tityrus** sp. n.

Characters: Insects of stout build. Vertex smooth; only in one somewhat aberrant species, *cleomenes* sp. n., does the vertex show the faintest trace of transverse striation. Pronotal keel often feebly developed, never completely free, either touching the posterior margin of the pronotum medially or completely fused with it here. Mesonotum falling fairly steeply to the pronotum, its surface densely clothed with fine pubescence. Basal carina of the propodeum considerably shorter than its forks except in *carus* sp. n. Hind coxa without a projection beneath at base; lobe of the hind tibia with a complete row of spines; hairs of the upper surface of the hind tibia at most $1\frac{1}{3}$ times as long as its middle width; hind tibia whitish or colourless on basal $\frac{2}{5}$ to $\frac{1}{2}$ (not very distinct in *guamensis* sp. n.). Area petiolaris of the propodeum separated from the areola by a perfectly formed ridge. Petiole short, stout, its epipleura reaching nearly to middle; gaster short and broad or broadly oval; tergite (2 + 3) sometimes with a feeble margin extending nearly to the 2nd spiracle, nearly always with some kind of sculpture, at least basally. Ovipositor variable in length.

MALAYA. BORNEO. PHILIPPINES. LADRONES IS. Eleven species.

In habitus the group is remarkably uniform and the chief differences between the species are to be found in the sculpture of tergite (2 + 3), length of the ovipositor, and colour.

The essential features of the group are the smooth vertex, the fine pubescence of the mesonotum and the simple hind coxa.

Key to the species of the **tityrus** group.—Females.

1. Tergite (2 + 3) virtually smooth . . . . 2.
–. Tergite (2 + 3) distinctly and usually conspicuously sculptured at least at base . . . . 3.
2. Hind tibia conspicuously brown and white . . *carus* sp. n. (p. 312).
–. Hind tibia almost uniformly yellowish fulvous *xanthippus* sp. n. (p. 312).
3. Thorax and petiole entirely bright fulvous. (Sp. with the gaster darker than the petiole both above and below; tergite (2 + 3) at base with an ill-delimited area of extremely fine punctate-reticulation) *aeolus* sp. n. (p. 309).
–. At least the propodeum darkened in part . . . . 4.

4. Ovipositor much longer than the whole abdomen . . . . 5.
–. Ovipositor not or hardly longer than the whole abdomen . . . . . . 6.
5. Tergite (2 + 3) on basal half finely striate-reticulate or merely striate; this sculpture sharply marked off from the finer, punctate-reticulate sculpture of the apical half; head at most only slightly paler than the thorax . . . . *tityrus* sp. n. (p. 304).
–. Tergite (2 + 3) on basal half somewhat unevenly but predominantly punctate-reticulate; this sculpture slightly stronger than that of the apical half but not sharply contrasted with it; head red, contrasting with the black thorax . . . . *troilus* sp. n. (p. 305).
6. Sculpture of tergite (2 + 3) consisting predominantly of very fine, much broken striation or aciculation . . . . 7.
–. Tergite (2 + 3) differently sculptured, having an ill-delimited basal area of extremely fine punctate-reticulation or sometimes punctate-striation . 8.
7. Gaster brownish throughout; thorax dark brown *ulpianus* sp. n. (p. 307).
–. Gaster brown and yellow; thorax in greater part obscure reddish *guamensis* sp. n. (p. 310).
8. Mesonotum entirely or almost entirely reddish or fulvous. (Spp. with the dorsal areas of the propodeum dull, in greater part finely scaly-reticulate) . . . . 9.
–. Mesonotum blackish . . . . 10.
9. Ovipositor sheaths not longer than the gaster . . . *typhon* sp. n. (p. 309).
–. Ovipositor sheaths about as long as the whole abdomen *diphylus* sp. n. (p. 311).
10. Hind coxae and hind femora yellowish fulvous; ovipositor sheaths about as long as the gaster . . . . *cleomenes* sp. n. (p. 311).
––. Hind coxae and hind femora dark brown; ovipositor sheaths about as long as the whole abdomen . . . . *virbius* sp. n. (p. 306).

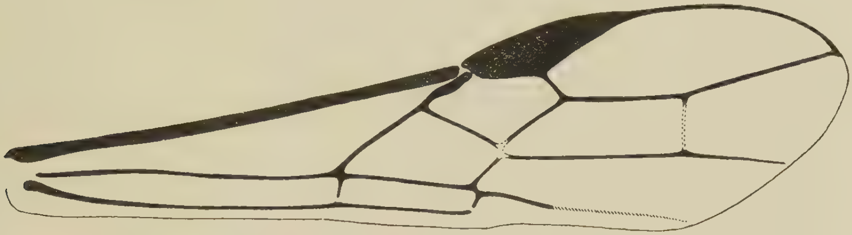
Spathius tityrus sp. n.

♀. Blackish, the head and abdomen slightly paler. Palpi whitish-yellow. Front and middle coxae usually predominantly honey-yellow but sometimes a little brownish; extreme base of the front and middle tibiae, the basal half of the hind tibiae and also the basal third of the 1st segment of the hind tarsus, whitish; otherwise, the legs brownish like the abdomen.

Head very distinctly narrower behind the eyes than across them (fig. 154). Face with fine, much broken, transverse striation mixed with rugulosity. Frons with a medial patch of transverse striation divided along the middle. Antenna 47-segmented (2 ♀♀); scape rather long; flagellum 1 a little longer than scape plus pedicel, 17 : 14 (fig. 146).

Thorax: Pronotal keel touching the posterior margin of the pronotum, sometimes completely fused with it medially; lateral area rather well defined, owing to the surface contiguous with it, especially that on the ventral side, having very fine, obsolescent sculpture. Mesonotum (fig. 151) rather strongly shining, especially posteriorly, and with only a very feeble surface sculpture in which are impressed minute punctures; posterior carinae reaching to about middle, straight and unbroken; only in one female out of seven are they somewhat broken. Scutellum feebly convex, shining, almost smooth. Propodeum, except within the dorsal areas, covered with short, fine hairs, more especially posteriorly; dorsal areas shining, medially with obsolescent sculpture and tending to become smooth. Mesopleural furrow smooth, extending only a little beyond middle; disc smooth and shining. Recurrens interstitial; nervus parallelus not interstitial; nervulus distinctly postfurcal (fig. 140). Middle tarsus not unusually short, segment 1 being about 5 times as long as wide; hairs of the upper surface of the hind tibia about $1\frac{1}{3}$ times the middle width of the tibia, set at about ×60; hind tarsus 1 less than twice 2; 3 exactly as long as 5.

Abdomen: Petiole about $1\frac{1}{2}$ times as long as the propodeum, strongly striated all over, the ridges somewhat confluent at about middle of segment; tergite (2 + 3) transverse, shorter than apically wide, about 35 : 43; the sculpture of the basal half stronger than that of the apical half and rather sharply separated from it; except for a wide smooth lateral margin, the sculpture of the basal area consists of fine striate-reticulation or simply fine, somewhat broken striations with the intervals faintly rugulose (Mindanao, 2 ♀♀); this segment has a fine lateral margin extending virtually to as far as the second spiracle; except for a smooth apical and lateral margin, the apical area of tergite (2 + 3) is dull, extremely finely punctate-reticulate. Following tergites with a very broad smooth apical margin but basally with a sculpture similar to that of the apical part of tergite (2 + 3) but much weaker. Ovipositor sheaths about as long as the thorax plus abdomen.



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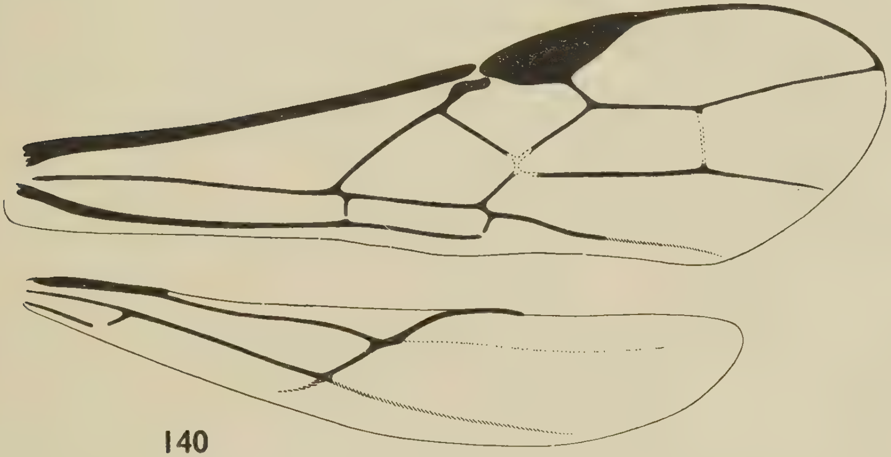

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FIGS. 139–140.—Wings of *Spathius*:—139. *Spathius voltur* sp. n.; 140. *S. tityrus* sp. n.

Length: 5–6 mm. without ovipositor.

BORNEO: Sandakan, 4 ♀♀, one the type (*Baker*). MALAYA: Singapore, 1 ♀ (*Baker*). PHILIPPINES: Mindanao, Zamboanga, 1 ♀, Butuan, 1 ♀ (*Baker*).
Type in U.S. National Museum.

This species seems to be characterised by the sculpture of tergite (2 + 3) and long ovipositor.

Spathius troilus sp. n.

Differs from *tityrus* as follows :—

♀. *Head* conspicuously reddish, contrasting with the colour of the rest of the body.

All the legs, from coxa to femur inclusive, uniformly brown; hind tibiae yellowish on rather more than basal third; tarsi brown throughout. At least the more basal segments of the palpi faintly brownish.

Head not so much narrower behind the eyes than across them, 31 : 33. Frons without transverse striation but with some vague obsolescent rugulosity which, close to the eye-margin, takes the form of 2–3 short, curved striations having more or less longitudinal direction. Face more or less evenly reticulate-rugose. Vertex, more especially towards the eye-margin, with the merest indication of transverse striation (× 60). Antenna broken, but flagellum 1 considerably longer than scape plus pedicel, 19 : 14.

Thorax: Pronotal keel very weak, medially coalesced with the anterior margin of the pronotum. Mesonotum slightly more elongate, duller, the sculpture stronger but essentially of the same type; posterior carinae not developed as such, being represented by a few longitudinal rugosities. Scutellum slightly dull, with a distinct though faint surface sculpture. Dorsal areas of propodeum with raised sculpture restricted to margins; the medial surface covered with a more or less even scaly-reticulation. Mesopleura with fine hairs virtually all over; disc not quite smooth. Nervus parallelus exactly interstitial. Hind tarsus 3 longer than 5, 11 : 8.

Abdomen: Petiole, at least in middle third, striate-reticulate, the striate element not conspicuous. Tergite (2 + 3) narrower, exactly as long as apically wide; no sharp separation between the sculpture of the basal half and that of the apical half; the surface, except for the smooth apical margin, very finely punctate-reticulate, slightly more weakly on about apical half of segment; further, tergite (2 + 3) becomes smooth towards the lateral margin but the smooth surface is much less sharply separated from the rugulose sculpture than in *tityrus*. Ovipositor sheaths about as long as the whole body.

Length: 5·8 mm., without ovipositor, which is 5·6 mm.

Borneo: Sandakan, 1 ♀, the type (*Baker*).

Type in U.S. National Museum.

This species is characteristic because of the red head and long third segment of the hind tarsus.

Spathius virbius sp. n.

This species is much more closely allied to *tityrus* than to *troilus*. It differs from the former species as follows:—

♀. *Head* behind the eyes only very slightly narrower than across them, 31 : 32 (fig. 141). Antenna with 50 segments (1 ♀, broken in others).

Thorax: Mesonotum posteriorly with two keels similar to those of *tityrus*, but less regular; sculpture of the mesonotum slightly stronger, hence this sclerite less shining than in *tityrus*. Scutellum with a clear indication of feeble punctures. Recurrens clearly not interstitial. Hind leg (fig. 142).

Abdomen: Petiole striate-reticulate on middle third (fig. 143). Tergite (2 + 3) on about basal half with a vague, variable sculpture which could be described as a combination of scaly-reticulation and broken longitudinal aciculation; on apical half there is very feeble, patchy surface sculpture which tends to be separated from the sculpture of the posterior part of the segment by a narrow smooth space; in certain lights, this apical part of tergite (2 + 3) shows smooth, highly polished surfaces. Following tergites smooth except for microscopic sculpture towards the base. Ovipositor sheaths shorter, about as ong as the abdomen.

Length: 5–6 mm. without ovipositor.

Philippines: Mindanao, Zamboanga, 1 ♀. Sulu Archipelago: I. of Basilan, 2 ♀♀, one the type (*Baker*).

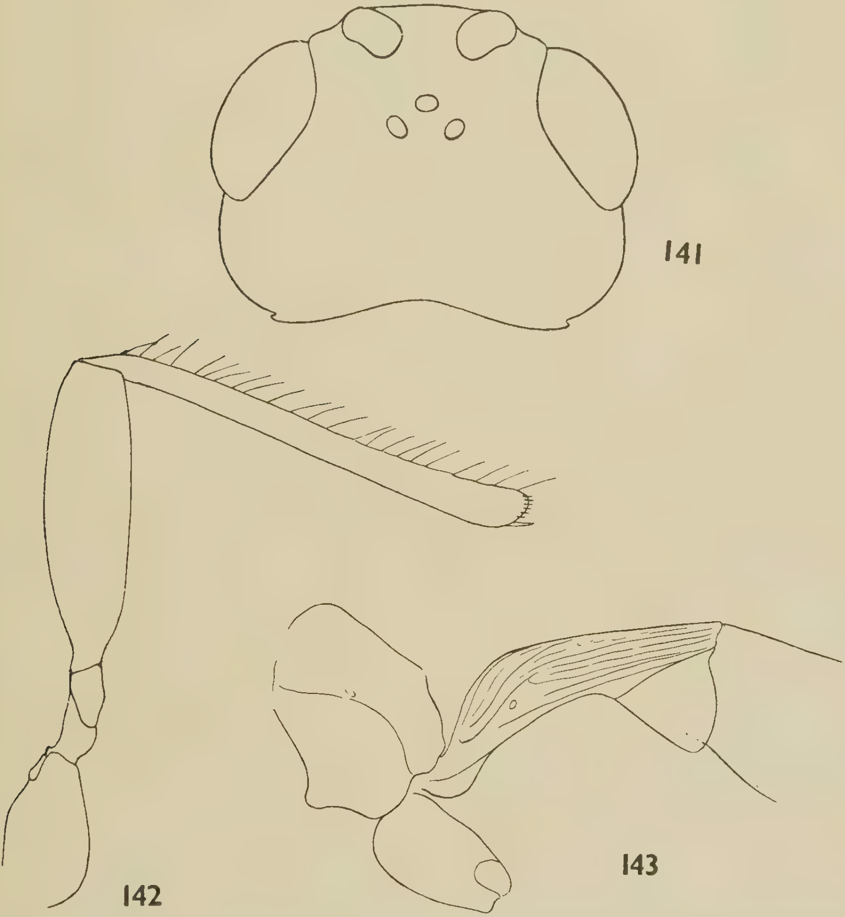
Type in U.S. National Museum.

Spathius ulpianus sp. n.

This species is very closely allied to *tityrus*, from which it differs as follows :—

♀. Head and thorax paler, sometimes the whole body being markedly brownish. Front and middle coxae pale honey-yellow; hind coxae likewise yellowish but deeper in colour, having a faint brownish tint; femora pale like the coxae.

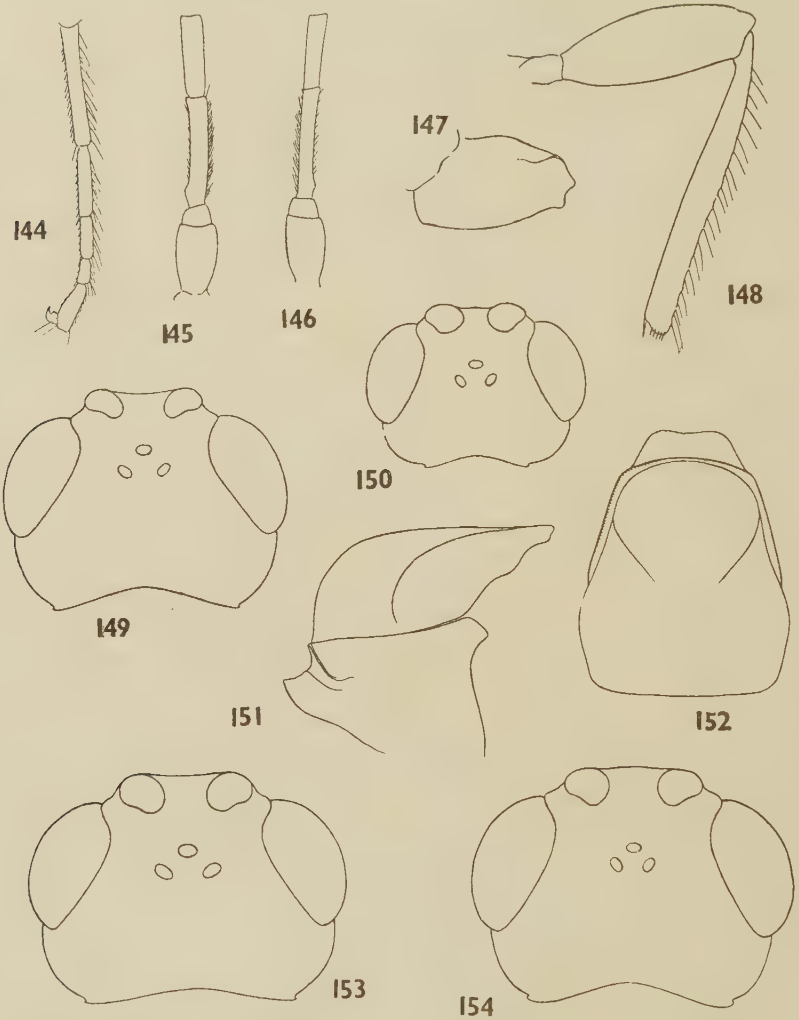
Antenna with 43–45 segments.



FIGS. 141–143.—*Spathius virbius* sp. n., ♀ :—141. head; 142. part of hind leg; 143. propodeum and petiole, lateral.

Mesonotum less shining, with a surface sculpture more in evidence; lateral lobes without a clear indication of punctures and covered with a more or less alutaceous sculpture in which there is a vague aciculate element, running obliquely towards the point of junction of the notaulices. Scutellum less smooth. Dorsal areas of the propodeum with a shining, more or less scaly-reticulate sculpture over most of their surface. Recurrens received into the 2nd cubital cell a little further from the 1st transverse cubitus; nervus parallelus more nearly interstitial. Tarsal segments more hairy (fig. 144).

Striations of the petiole much broken and confluent in about middle third. Basal half of tergite (2 + 3) with ill-defined, rather superficial aciculation which appears to be variable in direction; a semicircular basal patch tends to be concentric about the mid-basal point and apical to this patch the aciculation is virtually transverse; the apical half of the segment shows traces of extremely fine, transverse aciculation but the sculpture is by no means evenly distributed and in certain lights the surface tends to be strongly shining and nearly



Figs. 144–154.—144. *Spathius ulpianus* sp. n., hind tarsus, ♀; 145. *S. cleomenes* sp. n., 4 basal segments of antenna; 146. *S. tityrus* sp. n., 4 basal segments of antenna; 147. *S. cleomenes*, hind coxa, lateral; 148. *S. diphylus* sp. n., part of hind leg, ♀; 149. *S. voltur* sp. n., head, dorsal; 150. *S. typhon* sp. n., head, dorsal; 151. *S. tityrus* sp. n., anterior part of thorax, lateral; 152. *S. xanthippus* sp. n., mesonotum; 153. *S. carus* sp. n., head, dorsal; 154. *S. tityrus* sp. n., head, dorsal, type.

smooth. Following tergites with hardly a trace of sculpture. Ovipositor sheaths as long as the gaster plus petiole.

Length: 5–6·5 mm. without ovipositor.

Borneo: Sandakan, 5 ♀♀, one the type (*Baker*).

Type in U.S. National Museum.

This species is characterised by the sculpture of tergite (2 + 3) and the length of the ovipositor. The sculpture of the lateral lobes of the mesonotum is also characteristic in a subtle way, but it is probable that this feature is of doubtful value.

Two females I have before me from the Philippines (Luzon, Mt. Makiling and Mt. Banahao) may be a geographical race of this species. They have the head rather markedly yellowish-brown with the clypeus and the surface of the face bordering it darkened; the hind coxae are decidedly brownish and the femora are darker than in the nominate form; the mesopleural furrow is costate throughout; the aciculation of the basal half of tergite (2 + 3) tends to break up apically, and more especially in the middle of the segment, into fine aciculate-punctation.

Spathius aeolus sp. n.

♀. Differs from *tityrus* as follows :—

Thorax and petiole fulvous; head and gaster darker brown. Front and middle coxae more or less honey-yellow; hind coxae coloured like the thorax; basal half of the basal segment of the hind tarsus whitish.

Head decidedly less narrowed behind the eyes. Face with no obvious transverse element in its sculpture. Antenna with 42–43 segments (2 ♀♀).

Pronotal keel fused medially with the posterior margin of the pronotum. Mesonotum less shining, with a stronger surface sculpture; no clear indication of punctures on the lateral lobes at a magnification of ×60; posterior carinae not defined as such in one female; in the other much broken. Scutellum less shining. Dorsal areas of the propodeum shining and nearly smooth over most of their surface. Nervus parallelus interstitial in one female; in the other almost so; recurrens less nearly interstitial. Hind tarsus 1 to 2 as 3 : 2.

Abdomen: Petiole less smoothly striated. Less than the basal half of tergite (2 + 3) finely reticulate-punctate; this area is fairly clearly separated from the sculpture of the apical part of the segment which is finer and could be described as smoothly shagreened or very finely reticulate-punctate. Ovipositor sheaths in one female longer than the abdomen; in the other about as long as the abdomen plus propodeum.

Length: 5–5·6 mm. without ovipositor.

Borneo: Sandakan, 2 ♀♀, one the type (*Baker*).

Type in U.S. National Museum.

This is quite a strikingly coloured species.

Spathius typhon sp. n.

♀. Differs from *tityrus* as follows :—

Sides of the thorax blackish with reddish suffusion; mesonotum dull fulvous with a deepening of colour within the V formed by the posterior carinae; head shining brown; propodeum and petiole black; gaster for the most part chestnut-red, becoming slightly paler towards the apex. Front and middle coxae obscure honey-yellow; hind coxae and all the femora decidedly brownish.

Head (fig. 150) still narrower behind the eyes and more narrowed towards the occipital margin. Antenna with 37 segments (1 ♀).

Pronotal keel medially touching the posterior margin of the pronotum but more raised and sharper. Mesonotum not at all shining, its surface sculpture rather strong; posterior carinae well defined, almost unbroken. Scutellum all over with fine surface sculpture. Dorsal areas of the propodeum somewhat dull, covered all over with an even scaly-reticulation. Mesopleural furrow weakly transversely costate; the surface immediately ventral to the furrow somewhat roughened. Recurrens received into the 2nd cubital cell at a slightly greater distance from the 1st intercubitus; radius leaving stigma clearly proximal to middle.

Petiole about $1\frac{1}{3}$ times as long as the propodeum. Basal part of tergite (2 + 3) finely punctate-reticulate with a well-marked striate element; in the unique female, tergite (2 + 3) appears strongly transverse, 8 : 5, but this may be due to dorsoventral compression. Ovipositor sheaths hardly two-thirds as long as the whole abdomen.

Length: 4 mm. without ovipositor.

BORNEO: Sandakan, 1 ♀, the type (*Baker*).

This species is characterised by the combination of pale mesonotum, black petiole and very short ovipositor.

Spathius guamensis sp. n.

♀. Medium brown; head paler on face and around eyes; metapleura, subalar impression of the mesopleura, sides of pronotum and anterior depression of the scutellum darkened; the dorsal areas of the propodeum are markedly paler than the other parts of the thorax; petiole reddish; gaster yellowish, its dorsal surface with 5 wide brown bands which do not reach the lateral margin, so that, to the naked eye, the gaster appears brown, but yellow at base and along sides and with very narrow, almost linear, yellow bands; sometimes the brown colour is reduced so that the yellow transverse bands appear as wide as the brown ones. Flagellum dark brown throughout. Palpi whitish-yellow. Hind coxae and hind femora yellowish; hind tibiae faintly darkened in the middle but becoming colourless towards base; hind tarsi brownish.

Head slightly but distinctly narrower behind the eyes than across them. Face finely rugulose with very feeble transverse elements. Frons finely striate-rugose right to eye-margin. Vertex completely smooth. Base of the ocellar triangle clearly longer than its sides. Eyes rather large. Antenna with 33–34 segments (5 ♀♀); flagellum 1 as long as scape plus pedicel.

Thorax: Pronotal keel clearly defined but medially fused with the posterior margin of the pronotum; lateral area moderately well defined. Mesonotum falling almost vertically to the pronotum, its lobes weakly shining and everywhere with fine broken scaly-reticulation; posterior carinae sharply defined, more or less unbroken and with hardly a branch on their outer side; pubescence rather sparse, yellowish, consisting only of very short hairs. Scutellum slightly convex, almost smooth. Mesopleural furrow smooth or nearly so; disc smooth, shining. Propodeum: basal carina about $\frac{1}{2}$ as long as its forks; dorsal areas very clearly defined, without raised rugosities, their surface very shining and with obsolescent scaly-reticulation. Hairs of the hind tibia rather sparse, those on the upper surface set at about 30 degrees, the longest of them about as long as the middle width of the tibia, but most of them appearing a little shorter; hind tarsus 1 a trifle less than twice 2, 17 : 9; 3 is $\frac{2}{3}$ of 5. Nervus parallelus not interstitial.

Abdomen: Petiole smoothly striate within the apical dilatation, but elsewhere reticulate. Tergite (2 + 3) with a basal area (the yellow part) of extremely fine obsolescent striation which is more or less concentric about the mid-basal point. Ovipositor sheaths about as long as gaster plus petiole.

♂. Like the female, but the sculpture of tergite (2 + 3) stronger but less definite;

the striation tends to be longitudinal and much broken up so as to resemble vague striate-reticulation; also, there are traces of sculpture on the apical part of the segment.

Length: ♂, 2·5–3 mm.; ♀, 3·5 mm., without ovipositor.

LADRONES IS.: Guam, 14.i.1938, 5 ♀♀, one the type, 3 ♂♂, " ex ?*Anabellus* sp. in *Ochrocarpus* " (*R. G. Oakley*).

Type in U.S. National Museum.

This little species differs from all the other members of the group in the colour of the gaster.

Spathius diphylus sp. n.

A rather doubtful species closely resembling *typhon* sp. n. and *aeolus* sp. n. It differs from *typhon* in having a longer ovipositor and from *aeolus* in having the propodeum darkened in part.

It may be compared first with *tityrus* as follows :—

♀. Head fulvous yellow; mesonotum much the same colour but a little redder in tint; propodeum more or less black in the type but dull reddish in the paratype. Hind coxae and all the femora brownish. Gaster somewhat pale beneath, almost yellowish along edge and, in the smaller female, with a brownish spot near base.

Head less narrow behind the eyes, less transverse, more cubical as seen from above.

Pronotal keel decidedly sharper, more raised, touching the posterior margin of the pronotum. Mesonotum not at all shining. Scutellum less shining, the ground sculpture more in evidence. Dorsal areas of the propodeum on rather more than anterior half in type, virtually all over in paratype, with more or less dull scaly-reticulation. Mesopleural furrow with faint traces of costae; disc shining but with indication of obsolescent scaly-reticulation. Legs a little thicker, especially the hind femur, which is somewhat abruptly narrowed at base (fig. 148).

Petiole less smoothly striate, the interstices being very faintly rugulose. Basal part of tergite (2 + 3) finely punctate-reticulate, with a hardly noticeable longitudinal element; the sculpture of the apical part is more or less the same but finer and more indefinite and without a trace of longitudinal elements. Ovipositor sheaths about as long as the gaster.

Length: type, 5 mm. without ovipositor; paratype, 4 mm.

BORNEO: Sandakan, 2 ♀♀, one the type (*Baker*).

Type in U.S. National Museum.

I also refer to this species a single female (Sandakan) which has the thorax entirely pale fulvous and the petiole also of this colour.

Spathius cleomenes sp. n.

This species closely resembles *virbius* sp. n., but is, I am confident, distinct from that species, with which it may be compared as follows :—

♀. Hind coxae and hind femora fulvous yellow; whitish basal part of hind tibiae not forming a sharply delimited area, but the pale colour extending along the upper surface of the tibia almost to apex; the dark apical colour extends in similar fashion along the lower surface almost to base. Fore-wing paler, without the conspicuous cloud beneath the stigma which is a somewhat characteristic feature of *virbius*.

Head distinctly narrower behind the eyes than across them. Vertex with very faint traces of transverse striation. Scape shorter (fig. 145).

Lobes of the mesonotum duller, more obviously rugulose. Disc of the mesopleura with traces of scaly-reticulation. Dorsal areas of the propodeum transversely carinate. Hind coxa almost with a projection beneath (fig. 147).

Tergite (2 + 3) duller, its sculpture more definite; the basal area is extremely finely punctate-reticulate; the part apical to this shows a very even sculpture of scaly-reticulation, appearing almost shagreened. Ovipositor sheaths about as long as the gaster.

Length: 5·4 mm. without ovipositor.

PHILIPPINES: Port Banga, 1 ♀, the type (*Böttcher*).

Type in British Museum (Natural History).

I also refer to this species, provisionally, a single female from Sandakan (*Baker*) which differs slightly from the nominate form: the vertex shows no trace of striation at ×60; there is less encroachment towards the apex and towards the base of the pale and dark areas of the hind tibia and the ovipositor sheaths are slightly longer, almost as long as the whole abdomen.

Spathius xanthippus sp. n.

♀. A pallid species to the naked eye. Head and gaster honey-yellow; thorax and petiole pale red-brown but the petiole a little darker than the thorax. Legs pallid more or less throughout, the hind coxae and hind femora being more or less same colour as the gaster; hind tibiae pale on basal sixth and then very faintly darkened to middle.

Head only a trifle wider behind the eyes than across them, 19 : 18. Face finely rugulose, the transverse elements very feeble. Frons with very fine close striation. There is the merest trace of sculpture on each side of the ocellar triangle. Flagellar segment 1 a little longer than scape plus pedicel, 15 : 11. Ocellar triangle small, the ocelli almost in an equilateral triangle.

Thorax: Pronotal keel sharp, conspicuous, just touching the posterior margin of the pronotum at middle, showing as a brownish line and, when the thorax is seen from above, strongly raised, visible along the side of the pronotum for a distance about equal to its transverse length across the pronotal collar (fig. 152). Pubescence of mesonotum consisting of long and short hairs mixed; lobes dull, having a rugulose appearance; posterior carinae apparently fused to form a single wavy keel, which anteriorly sends out two much-broken forks along the course of the notaulices. Scutellum feebly convex, dull, scaly-reticulate. Mesopleural furrow closely costate; disc smooth near the furrow but showing some kind of rugosity elsewhere. Propodeum: ridge separating areola from the area petiolaris decidedly feeble, hardly emphasised, the two areas hence more or less confluent; dorsal areas dull, scaly-reticulate on roughly anterior half. Legs: hind tarsus 1 twice 2; 3 a trifle shorter than 5, 8 : 9. Nervus parallelus virtually interstitial.

Abdomen: Petiole about $1\frac{2}{3}$ as long as the propodeum, rather narrow, striate-rugose. Gaster smooth, except for the merest trace of convergent striation on each side at base. Ovipositor sheaths as long as the whole abdomen.

Length: 4–5 mm. without ovipositor.

MALAYA: Singapore, 3 ♀♀, one of the type (*Baker*).

Type in U.S. National Museum.

This is certainly an aberrant member of the group on account of the virtually smooth base of gaster and because it has the hind tibia pale only at extreme base. In the combination of these two features alone it differs from all its congeners. It should, I think, be emphasised that individuals or forms might occur in which there would be an increase in the amount of sculpture on tergite (2 + 3). What characterises *xanthippus* more significantly is the prominence of the pronotal keel, especially with regard to its appearance as seen from above.

Spathius carus sp. n.

♀. Head uniformly yellowish fulvous; mesonotum dull reddish; propodeum blackish; pronotum and mesopleura dull reddish variegated with darker suffusions; petiole black; gaster bright yellowish fulvous, darker beneath at base. Hind coxae and all the femora brown; hind tibiae whitish on basal half then brown, but becoming pale again at extreme apex; front tarsi brownish; middle tarsi whitish except for the brown apical segment; hind tarsi almost whitish-yellow but segments 1–4 faintly darkened towards apex; 5 entirely infuscated. Fore-wings with only a very faint cloud beneath the stigma.

Head a little narrower behind the eyes than across them (fig. 153). Face rugulose, with only very feeble transverse elements. Frons rather coarsely striate. Base of the ocellar triangle clearly longer than its sides. Flagellum brown; basal segments as in *tityrus* sp. n. (cf. fig. 146).

Thorax: Pronotal keel well developed, prominent, medially just touching the posterior margin of the pronotum. Mesonotum dull, closely sculptured; there is a trace of obsolescent punctation on lateral lobes; posterior carinae strong, well developed. Scutellum feebly convex, with traces of sculpture. Basal carina of the propodeum as long as its forks; dorsal areas shining, feebly scaly-reticulate over most of their surface. Mesopleural furrow wide, deep, transversely costate; disc with vague puncture-like rugosities and inequalities of surface but the spaces between them shining and smooth. Hind coxa rounded beneath at base; hind tarsus 1 less than twice 2, 26 : 15; 3 as long as 5. Nervulus rather widely postfurcal.

Abdomen: Petiole 1½ times as long as the propodeum, rather strongly widened towards apex, strongly and fairly regularly striated. Tergite (2 + 3) with the merest trace of sculpture at base; if this were developed it would take the form, at least basally, of longitudinal striation; only the merest trace of a differentiated lateral margin; this fades out long before the second spiracle. Ovipositor sheaths as long as the whole abdomen.

Length: 5 mm. without ovipositor.

PHILIPPINES: Negros, Cuernos Mts., 1 ♀, the type (*Baker*).

Type in U.S. National Museum.

I provisionally refer to this species a single female from Mindanao, Surigao, which differs from the nominate form chiefly in certain details of colour:—the head is darker brown (this may be due to discoloration); the gaster is on the whole dark to the naked eye; the sides of tergite (2 + 3) very narrowly and an apical lateral streak are yellowish; the epipleura of tergite (2 + 3) and of 4 are markedly yellowish; tarsi darker, the middle pair appearing dirty whitish-yellow; the base of tergite (2 + 3) shows traces of punctation.

Spathius carus is certainly a typical member of the group, much more so than *xanthippus*, but it differs from all its congeners except the latter species in having tergite (2 + 3) virtually smooth. From *xanthippus* it differs, in addition to the characters given in the key, in having larger ocelli, no prominent lateral development of the pronotal keel, a shorter, broader petiole and the disc of the mesopleura differently sculptured, *inter alia*.

Group of **voltur** sp. n.

This group, in which I include two species, is very closely allied to the group of *tityrus* and differs from it in having the mesonotum clothed with long, sparse hairs, which are restricted more or less to the course of the notaulices, and in not having the areola of the propodeum separated from the area petiolaris. This last character may not be of much value, but the difference in the vestiture of the mesonotum is an absolute one.

PHILIPPINES. Two species.

Spathius voltur sp. n.

♀. Dark brownish-black; head, mesosternum and abdomen more brownish than the upper parts of the thorax in tint. Antennae brown. Palpi yellow. Front and middle coxae hardly paler than the hind pair, which are evenly dark brown; all the femora dark brown; all the tibiae brown, except for basal fifth of the hind pair, which is yellow, and a yellow spot at the base of the others; tarsi brown, darkest in the type. Except for a brownish cloud around the 1st abscissa of the radius, the fore-wing is slightly and evenly brownish all over; stigma entirely brown. The above description applies to the type; it will cover a smaller female from Butuan, but another female of similar size from Mindanao, Davao, is evenly brown all over.

Head slightly wider across the eyes than behind them (fig. 149). Face rugose with a transverse tendency. Frons transversely striated. Vertex completely smooth. Base of the ocellar triangle very distinctly longer than its sides. Antennae with at least 49 segments.

Thorax: Pronotal keel well developed and sharp throughout, but medially fused with the posterior margin of the pronotum; lateral area well defined. Mesonotum falling fairly steeply to the pronotum but by no means perpendicularly; lobes rather strongly shining and with very fine subscaly-reticulation; posterior carinae well defined. Scutellum very slightly convex, sculptured like the lobes of the mesonotum. Basal carina of the propodeum a trifle longer than its forks; dorsal areas shining, with extremely weak scaly-reticulation confined to about basal half. Disc of the mesopleura shining, almost smooth; the furrow itself weakly costate. Legs: hind coxa evenly rounded beneath at base; hairs of the upper surface of the hind tibia bristly, almost erect, very slightly longer than the middle width of the tibia; apical lobe with a complete row of stout spines; hind tarsus 1 slightly less than twice 2, 11 : 6; 3 as long as 5. Recurrens nearly interstitial; nervus parallelus not interstitial (fig. 139).

Abdomen: Petiole 1⅓ times as long as the propodeum, predominantly rugose-reticulate over basal two-thirds. Tergite (2 + 3) shorter medially than its apical width, laterally with traces of a margin as far as the second spiracle; at base this tergite shows a semicircular area of extremely fine punctate-reticulation; posterior to this area and up to the wide smooth apical margin, the surface has a similar but considerably finer sculpture; the apical margin is for the most part smooth but shows traces of fine transverse aciculation. Following tergites similarly sculptured but becoming progressively more finely so. Epipleura of tergite (2 + 3) very shining and with traces of microscopic punctation. Ovipositor sheaths a little longer than the gaster.

Length: 4·4–6·3 mm. without ovipositor.

PHILIPPINES: Mindanao, Butuan, 1 ♀; Davao, 1 ♀; I. of Basilan, 1 ♀, the type (*Baker*).

Type in U.S. National Museum.

The female from Butuan has a narrow longitudinal yellowish band which encloses the mesopleural furrow and a part of the surface on each side of it.

Spathius casius sp. n.

This species is very closely related to *voltur* and were it not that the localities overlap, I should be inclined to regard the present form merely as a race of *voltur*. It differs as follows :—

♀. Size smaller (this may of course be of no significance as only four females are available). Distinctly dark brown to the naked eye. Front and middle coxae and basal *half* of the hind tibiae whitish-yellow; tarsi yellowish, tinted with brown.

Antennae 45-segmented in the type. Pronotal keel slightly less raised, free but close to the posterior margin of the pronotum. Anterior slope of the mesonotum more gradual; lobes markedly less shining, the surface quite dull, the scaly-reticulation close and giving a somewhat beaded effect. Mesopleura more rugose, especially in the two females from

Mindanao and the Island of Basilan, in which specimens no completely smooth spaces are present here.

Length: 4·6 mm., the type; 3·3 mm., smallest female (Basilan).

BORNEO: Sandakan, 2 ♀♀, one the type (*Baker*). PHILIPPINES: Mindanao, Zamboanga, 1 ♀. I. of Basilan, 1 ♀ (*Baker*).

Type in U.S. National Museum.

Group of **leucippus** sp. n.

Characters: Brightly coloured species, often with a testaceous head and a brown patch behind each eye or the gaster variegated with brown and yellow.

Vertex smooth or almost so; only in one species (*miletus* sp. n.) does it show some sculpture immediately behind the ocelli. Head always distinctly narrower behind the eyes than across them. Pronotal keel well developed, free (in *miletus* it is placed close to the posterior margin of the pronotum). Hairs of the mesonotum sparse and outstanding. Wings (fig. 155); nervus parallelus not interstitial. Tergites (2 + 3) and 4 with a complete sharply differentiated lateral margin; tergite 4 disproportionately larger than 5 and with a sculpture entirely different from this.

JAVA. BORNEO. PHILIPPINES. FORMOSA. Five species.

The group is made up of a somewhat heterogeneous assemblage of species; the one important character that they all have in common is that tergite 4 is disproportionately larger than 5. The insects are all of slender build.

Key to the species of the **leucippus** group.—Females.

1. Body entirely pale reddish-yellow . . . . . . *delicatus* sp. n. (p. 319).
–. Body darkened at least in part . . . . 2.
2. Gaster unicolorous orange-yellow; hind coxae merely angled beneath at base. (Sp. with black thorax and the greater part of the head pale testaceous) . . . . *naisus* sp. n. (p. 317).
–. Gaster blackish or brownish, marked with yellow; hind coxae with a distinct projection beneath at base . . . . 3.
3. Tergite (2 + 3) almost twice as long as its apical width, about 11 : 6 (measured medially). (Sp. having the mesopleura with some kind of sculpture everywhere) . . . . *miletus* sp. n. (p. 317).
–. Tergite (2 + 3) at most $1\frac{1}{3}$ times as long as its apical width . . . . 4.
4. Basal half of tergite (2 + 3) with 2 subtriangular yellow spots on each side within the brown area; tergite (2 + 3) as long medially as its apical width . . . . *cyparissus* sp. n. (p. 318).
–. Basal half of tergite (2 + 3) without yellow spots within the brown area; tergite (2 + 3) considerably longer medially than its apical width *leucippus* sp. n. (p. 315).

Spathius leucippus sp. n.

♀. Species marked with black, red-brown and yellow; head pale honey-brown with a dark patch behind each eye; mesonotum uniformly brownish-red; propodeum mostly blackish; sides of the thorax in greater part same colour as the mesonotum but suffused with blackish along the depression of the pronotum and on the mesopleura beneath the wings; petiole blackish; tergites (2 + 3) and 4 blackish-brown, broadly margined laterally and apically with yellow, the yellow more extensive at apical corners; following tergites yellow (fig. 158). Palpi whitish-yellow. Scape and pedicel much the same colour as the head; flagellum darker. Legs, throughout, the same colour as the head with a dark patch on each side of the hind femora. Fore-wings slightly embrowned but unicolorous; stigma brown, slightly yellowish at base and apex.

Head very distinctly narrower behind the eyes than across them, the eyes prominent (fig. 160). Face transversely rugose-striate, becoming smooth along the mid-line. Frons with strong, more or less even striation. Vertex and head behind the eyes smooth, shining. Ocelli in a triangle with base much longer than sides. Antenna with 49–55 segments (2 ♀♀); flagellum 1 as long as scape plus pedicel.

Thorax rather narrow (fig. 163). Pronotal keel well developed, free; lateral area of the pronotum defined, evenly ribbed but the ribs broken up into fine striation when they extend beyond the anterior limits of the area. Lateral lobes of the mesonotum with only a narrow, linear strip of fine sculpture, their surface otherwise being covered with coarse smooth rugosities; posterior carinae clearly defined, almost parallel, wrinkly. Basal carina of the propodeum about as long as its forks; dorsal areas longer than wide, very shining, and almost smooth medially. Mesopleural furrow smooth; disc virtually smooth; subalar impression with only the merest trace of pubescence and with strong longitudinal striation. Front tarsus not much longer than its tibia, 21 : 16; hind coxa with a distinct projection beneath at base; longer hairs of the upper surface of the hind tibia fully twice as long as its middle width; apical lobe with a complete row of spines; hind tarsus 1 twice 2; 3 is $\frac{4}{5}$ of 5. Wings (fig. 155).

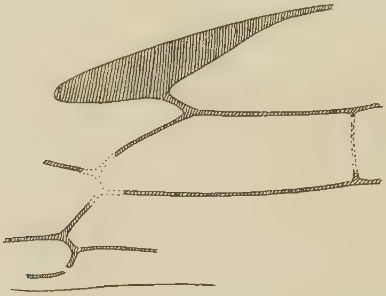


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FIG. 155.—*Spathius leucippus* sp. n., part of fore-wing, ♀.

Abdomen: Petiole $2\frac{1}{2}$ times as long as the propodeum, its sculpture, except at apex, somewhat obsolescent and its surface strongly shining. Tergite (2 + 3) not much widened to apex, its apical margin shallowly emarginate (fig. 158); the entire surface of the segment is covered with fine, wrinkly, longitudinal ridges, the intervals between them everywhere rugulose. Tergites (2 + 3) and 4 with a completely differentiated lateral margin. Tergite 4 large, completely differentiated in size and sculpture from 5; the apical margin of the tergite is rounded laterally and its sculpture is essentially like that of (2 + 3) except that the more lateral striations converge towards the mid-apical point and sometimes become continuous along the apical margin. Following tergites with at most very feeble surface sculpture. Ovipositor sheaths as long as the whole body.

Length: 6–6·5 mm. without ovipositor; one small ♀ measures 4 mm.

♂. Thorax pale brownish-red everywhere; gaster showing 4 tergites (2 + 3), 4 and 5, all of which have an equal degree of sculpture; the striation is stronger than in the female; on 4 the ridges are not continuous along the apical margin but they are continuous on 5.

Length: 5–6 mm. without ovipositor.

BORNEO: Sandakan, 5 ♀♀, one the type, 2 ♂♂ (*Baker*).

Type in U.S. National Museum.

In the smallest female, 4 mm., the thorax is entirely pale brownish-red as in the male and the distinctive contrast between brown and red is lost. The sculpture of the mesonotum is finer, the longitudinal band of fine sculpture on the lateral lobes being wider and less sharply marked off from the surrounding rugosities.

This species is distinctive on account of the conformation of the tergites and the colour and sculpture of tergite (2 + 3).

Spathius naisus sp. n.

♀. Like *leucippus* sp. n., from which it differs as follows :—

Frons, a large quadrate patch on the face, covering most of it, black-brown; vertex and temples testaceous yellow except for a conspicuous dark brown patch behind each eye; thorax virtually black throughout; gaster evenly yellowish orange in type; in 2nd female with a broad medial dark band, having a purplish tint.

Hind femora uniformly pale reddish-brown; hind tibiae darker than their femora but becoming pale towards apex; basal segment of the hind tarsus darkened.

Striation of the frons coarser, extending farther back towards vertex on each side of the ocellar region; one or two grooves are continuous behind the posterior ocelli. Ridges of the sides of the pronotum more even, stronger, and giving a more markedly ribbed effect, the ribs extending virtually unbroken beyond the limits of the area to as far as the anterior lateral margin of the pronotum. Basal projection of the hind coxa less distinct, the coxa being merely angled in profile. Gaster narrower; tergite (2 + 3) longer, its middle length to its apical width as 16 : 25.

Length : 7–8·5 mm. without ovipositor.

♂. Paler in colour than the female, the thorax being mostly rugose with a slight suffusion of black on dorsal surface of propodeum; gaster dull purplish orange, the segments slightly darkened in the middle to the naked eye. In the unique male, the striation to sides of the ocelli is more feeble than in the female, but nevertheless distinct.

PHILIPPINES : Mindanao, Iligan, 1 ♀, the type, 1 ♂ (*Baker*); Zamboanga, 1 ♀ (*Baker*).

Type in U.S. National Museum.

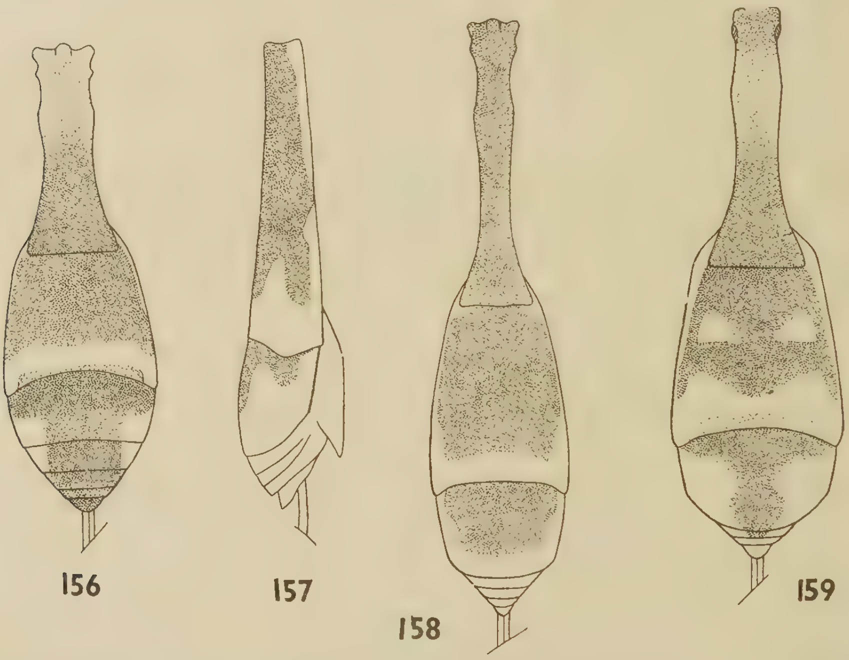
This is a striking-looking species on account of the colour of the gaster.

Spathius miletus sp. n.

A rather more slender species than either *leucippus* or *naisus* and less brightly coloured ; it may be compared with *leucippus* as follows :—

♀. Pale parts of the head dirty white; face, except towards the cheeks and narrowly along the orbits, frons and most of the middle part of the vertex, suffused with very pale brown; temples with the usual dark patch behind each eye; thorax predominantly brown suffused with dull testaceous on anterior part of the middle lobe and along the inner border of the lateral lobes, on middle part of the mesopleura and on the metapleura; tergite (2 + 3) dull brown with a faint reddish tint, narrowly margined laterally with yellow, the yellow border wider on apical half of the segment; at the apical corner, this margin joins up with a large oblong yellow patch which is separated from the yellow margin itself by a projecting tongue of brown colour (fig. 157); tergite 4 with a similar but larger yellow patch at each apical corner. Legs mostly dingy testaceous; hind coxae suffused with brown, more towards apex and laterally; hind femora mostly pale, except for apex above and basal $\frac{1}{3}$ which are testaceous; hind tibiae with a brown ring at middle and at base, otherwise testaceous.

Head less narrowed behind the eyes. Striation of the frons finer; a band of this striation borders the ocelli on the vertex side, so that only the posterior $\frac{2}{3}$ of the vertex is smooth. Pronotal keel less sharply defined and medially almost touching the posterior margin of the pronotum; lateral area with strong ribs which do not extend forwards beyond its anterior margin. Mesonotum less strongly rugose, the rugae weaker and less shining, the longitudinal band of fine sculpture on the lateral lobes not at all linear in appearance, the fine sculpture merging irregularly into the rugose sculpture. Propodeum less shining and with much fine rugosity in addition to the raised rugae; basal carina nearly twice as long as its forks, though these and the areola itself are hardly defined; dorsal areas very poorly defined, with raised rugosities over most of their surface but anteriorly showing a merely scaly-reticulate space. Medial part of the mesopleura with strong rugae all over; subalar impression with finer, more broken striation. Hind coxa with a more prominent projection; hind tarsus 1 more than twice 2, 7 : 3; hairs of the upper surface of the hind tibia slightly shorter than in *leucippus*. Petiole not so strongly shining, being covered with a fine surface sculpture in addition to its raised rugosities. Tergite (2 + 3) narrower, longer, almost parallel-sided; 4 apparently not so sharply differentiated in sculpture from 5 as in *leucippus*; 5 shows a clear indication of fine, transverse apical striation more or less similar to that of the apex of 4.



Figs. 156–159.—Abdomen of *Spathius*:—156. *Spathius pompelon* sp. n.; 157. *S. miletus* sp. n.; 158. *S. leucippus* sp. n.; 159. *S. cyparissus* sp. n.

Length: 8·5 mm. without ovipositor.

Formosa: Hoozan, xi.1910, 1 ♀ (*Sauter*).

Type in British Museum (Natural History).

Spathius cyparissus sp. n.

In general coloration this species is very like *leucippus*, from which it differs as follows:—

♀. In addition to the brown patch behind each eye, there is a faint elongate brown patch on the vertex behind the ocelli; mesonotum with a blackish suffusion along the posterior prolongation of the middle lobe, between the two posterior carinae; a black streak on side of pronotum along the depression; another on the mesopleura beneath the wings and another along the mesopleural furrow; pale parts of the thorax more yellowish; propodeum blackish around the posterior margin and with a broad blackish medial band, otherwise yellowish, the pale colour extending over the greater part of the metapleura; abdomen marked with brown and yellow as in fig. 159. Hind femora conspicuously blackened medially and the hind tibiae with a conspicuous black band medially; middle and front legs with similar dark marks but much reduced in size.

Striation of the frons less smooth, and towards the eye-margin merging into fine rugulosity. Vertex with indication of obsolescent striation more especially towards front, but the surface predominantly smooth. Antenna broken but scape and pedicel as in *leucippus*. Thorax slightly less narrow. Sculpture of the mesonotum much less strong; fine sculpture of the lateral lobes not restricted to a medial linear band but extending inwards virtually to as far as the notaulices. Dorsal areas of the propodeum less shining, the greater part of their anterior surface covered with fine scaly-reticulation. Mesopleural furrow costate throughout; disc covered with obsolete rugosities; nowhere with extensive smooth spaces. Petiole slightly less than twice as long as the propodeum, less shining and with clear indication of fine scaly-reticulation superimposed on the raised rugosities. Tergite (2 + 3) shorter, by no means nearly parallel-sided, as long medially as its apical width.

JAVA: Gebang, Bantar, 1 ♀ (*Bryant & Palmer*).
Type in British Museum (Natural History).

Spathius delicatus sp. n.

This species differs from *leucippus* as follows:—

♀. Entirely pale reddish-yellow with the ovipositor distinctly shorter than the body. Sculpture of the mesonotum finer, the lobes having a fine subscaly-reticulation over the greater part of their surface. Tergite (2 + 3) decidedly shorter in proportion to its apical width.

Length: 3·6 mm. without ovipositor.

BORNEO: Sandakan, 1 ♀ (*Baker*).
Type in U.S. National Museum.

I am not absolutely certain that this is a good species, though the striking colour difference, apparent when a comparison is made even with the smallest female of *leucippus*, seems to justify a new name.

Group of **pompelon** sp. n.

Characters: Brightly coloured species with the head either entirely pale or marked with sharply discrete brown patches. Hind coxae entirely pale.

Head distinctly narrower behind the eyes than across them. Vertex sculptured or smooth. Pronotal keel well developed, free or just touching the posterior margin of the pronotum. Recurrens almost interstitial; nervus parallelus by no means interstitial (fig. 167). Hind coxa with a dentiform projection at base. Tergite (2 + 3) with a characteristic sculpture of fine wrinkly striation, the interstices rugulose; tergite (2 + 3) and 4 with a completely differentiated lateral margin; the tergites beyond (2 + 3) proportional in size; gaster ovate (fig. 156).

BORNEO. PHILIPPINES. Two species and one variety.

This is not a very clearly defined group, although the two species I include in it are easily recognised. In general coloration there is perhaps a fairly strong resemblance to the group of *leucippus*, from which assemblage the present unit differs chiefly in not having tergite 4 disproportionately larger than 5.

Key to the species of the **pompelon** group.—Females.

1. Middle tarsus short, stout, segment 1 being hardly twice as long as wide; vertex strongly transversely striate . . . . *pompelon* sp. n.
–. Middle tarsus not short, not particularly stout, segment 1 being fully 3 times as long as wide; vertex at most with faint transverse striation . . . 2.
2. Lobes of the mesonotum in greater part with a fine surface sculpture; petiole in part reddish . . . . *sulmo* sp. n.
–. Lobes of the mesonotum with coarse shining rugae which leave free on each lateral lobe a linear area of fine scaly-reticulation; petiole blackish throughout . . . . *sulmo* sp. n., var. *basilanensis* var. n.

Spathius pompelon sp. n.

♀. Species having much the same colour pattern as *leucippus* sp. n.; much variegated. Dark brown, reddish-brown and honey-yellow; head pale honey-yellow with the following brown marks :—a brown suffusion along the middle line of frons and vertex, narrowing to a point at the occipital margin; a conspicuous oblong patch behind each eye on temples which joins to form a band across the occiput. Thorax marked with blackish and reddish-brown as follows :—pale reddish-brown are, the pronotum above and along the upper posterior margin, the greater medial part of the mesopleura, metapleura and to some extent the anterior part of the propodeum; mesonotum sometimes predominantly pale reddish-brown with a dark oblong mark on each lobe; sometimes these marks much increased in size; usually that on the middle lobe darker than those on the lateral lobes. Petiole dark brown, sometimes suffused with reddish towards base; tergite (2 + 3) brown, narrowly margined with yellow laterally and with a broad yellow apical band (fig. 156); 4 with a broad yellow apical band; 5–7 with a large brown medial spot, all of which together show as a broad band when the segments are closely retracted. Ventral surface of the gaster yellow. Legs predominantly yellow; hind femora, except at base, hind tibiae at base and with a broad band at middle, basal segment of hind tarsus, brown; the same arrangement of dark markings occurs on the other legs but to a much less characteristic extent. Stigma yellowish at base.

Head considerably narrower behind the eyes than across them. Frons and vertex strongly, smoothly, somewhat confluently, transversely striated, the ridges tending to be concentric around the ocellar triangle. Antenna with about 50 segments; flagellum 1 as long as scape plus pedicel.

Thorax of two types, which may represent two species but I can find no sharp line of separation; in the first type, the pronotal keel almost touches the posterior margin of the pronotum and the mesonotum falls somewhat abruptly to the pronotum (from one of these examples I have selected the type specimen); in the second case, the pronotal keel is quite free and the mesonotum has a less abrupt slope to the pronotum. Hairs of the mesonotum somewhat numerous, especially around the anterior limits of the notaulices where they are shorter; lobes of the mesonotum covered almost everywhere with strong smooth rugae; a narrow linear band of fine sculpture present on each lateral lobe. Propodeum almost everywhere covered with strong, somewhat transverse rugae; areola hence not clearly defined. Mesopleura coarsely rugose-striate all over. Hind tibia with a complete row of spines; hind tarsus 1 more than twice 2, 7 : 3; 3 not much more than half 5, 8 : 15; middle tarsus very short, stout, segment 1 being hardly twice as long as wide; 4 hardly 1½ times as long; hairs of the upper surface of the hind tibia about 1⅓ as long as its middle width. Wings (fig. 167).

Abdomen: Petiole varying from 1½ to about twice the length of the propodeum; the shorter petiole (fig. 156) is correlated with type (1) of the thorax; tergite (2 + 3) as long as apically wide, with very fine, somewhat wrinkly striation, the interstices rugulose;

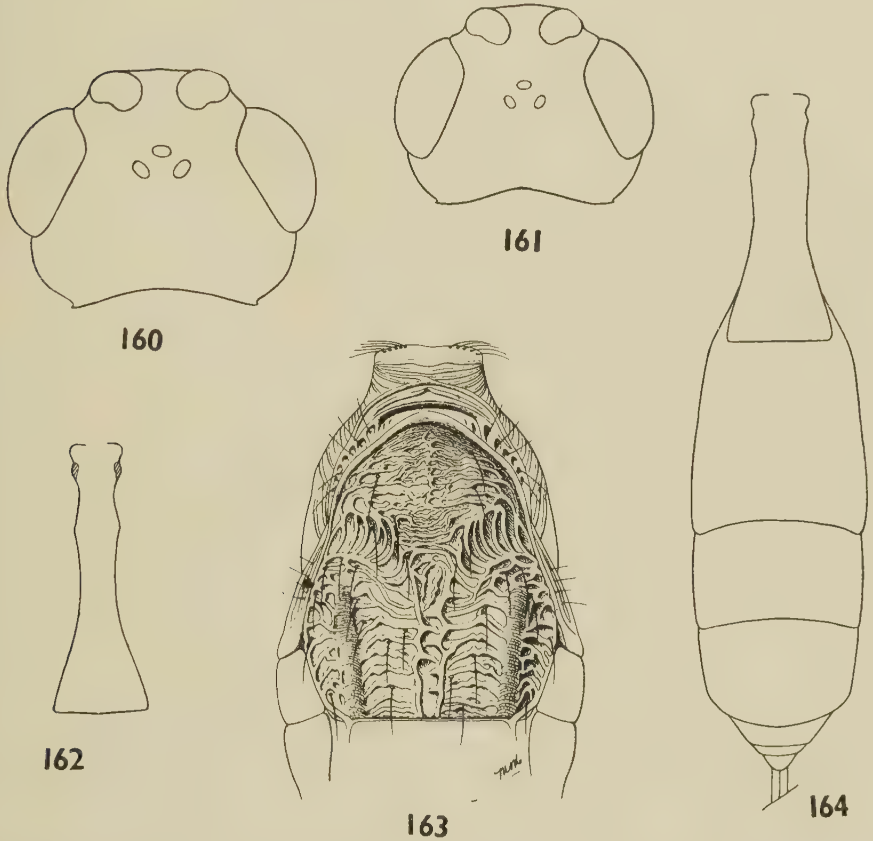
the pale apical margin of the segment is thin and membranous; tergite 4 more finely striate than (2 + 3), its apical margin thin, membranous, closely applied to the surface of the next tergite (cf. *leucippus*). Ovipositor sheaths distinctly a little longer than gaster plus petiole.

Length: 5–6 mm. without ovipositor.

Philippines: Luzon, Mt. Makiling, 5 ♀♀; Mt. Banahao, 3 ♀♀, one the type (*Baker*).

Type in U.S. National Museum.

This species is very distinct on account of colour and heavily sculptured vertex, mesonotum and mesopleura. The short middle tarsus seems also to be diagnostic.



Figs. 160–164.—160. *Spathius leucippus* sp. n., head, dorsal; 161. *S. seriphus* sp. n., head, dorsal; 162. *S. sulmo* sp. n., petiole; 163. *S. leucippus* sp. n., mesonotum; 164. *S. seriphus* sp. n., abdomen.

The differences referred to in the shape of the thorax and length of the petiole are bewildering. They would, of course, be more significant if they could be correlated with a difference in locality; but this is not the case. Further study of the species based on more material is necessary.

Spathius sulmo sp. n.

Closely allied to *pompelon* but differing from it as follows :—

♀. Colour much more uniform. Head and thorax evenly reddish-yellow; basal half of the petiole coloured like the thorax, then slightly darkened in the type; tergite (2 + 3) brown, narrowly yellowish along the lateral and apical margin; the lateral margin is slightly dilated medially and apically; tergite 4 with the same distribution of colour as (2 + 3); following tergites obscure honey-brown. Legs honey-yellow; hind femora slightly infuscated on outer side.

Vertex entirely smooth. Antenna with 42 segments (1 ♀). Striation of the frons finer.

Mesonotal hairs longer and sparser. Pronotal keel widely separated from the posterior margin of the pronotum. Anterior slope of the mesonotum gradual; lobes predominantly finely sculptured, the sculpture of the lateral lobes by no means forming a delimited linear area. Propodeum more finely sculptured; basal carina and areola weak but sharply delimited; basal carina a little longer than its forks. Mesopleura almost smooth over its medial part. Hind tarsus 1 exactly twice 2; middle tarsus not especially stout, segment 1 being fully 3 times as long as wide.

Petiole about 1½ times as long as the propodeum, unusually strongly widened at apex (fig. 162); tergite 4 finely reticulate-punctate.

Length : 5 mm. without ovipositor.

BORNEO : Sandakan, 1 ♀, the type (*Baker*).
Type in U.S. National Museum.

Spathius sulmo var. **basilanensis** var. n.

This form differs from *sulmo* only in having the propodeum and petiole almost black, and the sides of the thorax suffused with blackish.

The vertex has a clear indication of feeble transverse striation. Mesonotum almost as rugose as in *pompelon*. Raised rugosities of the propodeum stronger.

PHILIPPINES : I. of Basilan, 1 ♀ (*Baker*).
Type in U.S. National Museum.

Group of **seriphus** sp. n.

Spathius seriphus sp. n.

♀. Head and thorax yellowish-red, the propodeum suffused with blackish on its posterior face; petiole dark reddish-brown; gaster mostly deep ochreous yellow; tergites (2 + 3)-5 with a large reddish-brown patch, that on tergites 4 and 5 leaving the tergites broadly yellow at sides and apex. Legs honey-yellow throughout; hind femora with hardly a trace of infuscation.

Head only slightly narrower behind the eyes than across them. Frons very finely transversely striate. Vertex virtually smooth; at most the merest trace of sculpture medially, visible at × 40; this may be expected to be stronger or weaker in other individuals. Eyes rather large in a dorsal view of the head but not prominent (fig. 161). Base of the ocellar triangle slightly longer than its sides.

Thorax : Pronotal keel well developed, free. Mesonotum sloping gradually to the pronotum, clothed sparsely with long outstanding hairs; lobes in greater part with a fine surface sculpture. Basal carina of the propodeum 1½ times as long as its forks; areola clearly defined; dorsal areas shining, almost all over with raised though very feeble rugosity. Anterior tarsus not much longer than its tibia, 13 : 11; lobe of the hind tibia with a row of very feeble spines; hind tarsus 1 exactly twice as long as 2; middle tarsus 1 fully 3 times as long as wide. Mesopleural disc nearly smooth. Wings like those of *pompelon* (cf. fig. 167).

Abdomen: Petiole rather thick, slightly less than twice the length of the propodeum, about 11 : 6. Gaster almost parallel-sided (fig. 164); tergites (2 + 3)–5 with a sharp completely differentiated lateral margin; 5 disproportionately larger than 6; (2 + 3)–5 dull, with very fine wrinkly longitudinal striation, the interstices of the ridges rugulose. Ovipositor sheaths a little longer than gaster plus petiole.

Length: about 4·5 mm. without ovipositor.

MALAYA: Singapore, 1 ♀ (*Baker*).

Type in U.S. National Museum.

This species is very characteristic on account of having the first three segments of the gaster heavily sclerotised and tergite 5 disproportionately larger than 6. The only other species of *Spathius* which have this last character occur within the *striolatus*-group—*hephaestus* and *libanius* spp. n.—but they are both distantly related to *seriphus*.

Group of *striolatus* Cameron.

Characters: The species I include in this group form a heterogeneous and perhaps not very natural assemblage. Insects of stout build. Colour variable but the palpi always whitish-yellow. Head rather strongly transverse, at most only a little narrower behind the eyes than across them. Scape of the antenna often decidedly elongate. Pronotal keel more or less undeveloped and apparently fused with the posterior margin of the pronotum. Mesonotum usually subtruncate in front and in any case always falling vertically to the pronotum; except in *myrtilus* sp. n., always with a great deal of coarse rugosity. Scutellum more or less flat. Disc of the mesopleura never extensively smooth (cf. *striaticeps* Cam.), usually coarsely rugose everywhere. Legs stout; hind coxa usually without a projection; apical lobe of the hind tibia with or without spines; hind tarsus 1 never more than twice 2, usually a trifle shorter; hind tarsus 3 at most ⅔ as long as 5. Wings evenly tinted; nervus parallelus never interstitial (fig. 165). Petiole short; gaster short and wide, appearing flat or even concave beneath; tergites (2 + 3)–5, except in *striolatus* Cameron, with a completely differentiated lateral margin; the epipleura of these tergites thin, membranous, unsculptured; tergite (2 + 3) always strongly sculptured and always with longitudinal elements in its sculpture. Ovipositor longer than the abdomen.

CEYLON. BORNEO. PHILIPPINES. Five species and two varieties.

The most salient and unifying features of the group are:—(1) the transverse head, (2) the shape of the mesonotum in front and (3) the conformation of the gaster.

Cameron created the genus *Rhacospathius* for his species *striolatus* and it was sunk by Wilkinson in 1931. No useful purpose would be served, I think, in employing the name, especially since *striolatus* is no better characterised than a great many other species whose position within *Spathius* I have preferred to define by means of the species-group concept.

Key to the species of the *striolatus* group.—Females.

1. Tergite (2 + 3) strongly smoothly striate, the intervals smooth, shining . . 2.
–. Tergite (2 + 3) never smoothly striate . . . . 3.
2. Propodeum and metapleura bright reddish, contrasting sharply with the rest of the thorax which is more or less blackish . . . *striaticeps* Cameron.
–. Propodeum and metapleura blackish like the rest of the thorax *striaticeps* Cam., var. *zamboangensis* var. n.
3. Mesonotum densely clothed with fine more or less adpressed pubescence . . 4.

–. Mesonotum clothed only with long sparse outstanding hairs . . . . . . 5.
4. Vertex finely, smoothly striate; thorax in greater part reddish . *myrtilus* sp. n.
–. Vertex almost smooth, with only a faint trace of striation; thorax entirely blackish . . . . *myrtilus* var. *niger* var. n.
5. Vertex coarsely sculptured; tergite 5 disproportionately larger than 6 and with fine striation running more or less parallel to its apical margin . . . 6.
–. Vertex more or less smooth; tergite 5 not disproportionately larger than 6, its apical margin without striation. (Blackish species with the basal $\frac{2}{3}$ of tergite (2 + 3) orange-yellow) . . . . *striolatus* Cameron.
6. Entirely reddish-brown species; tergite (2 + 3) about as long medially as its apical width . . . . *hephaestus* sp. n.
–. At least the thorax blackish; tergite (2 + 3) clearly shorter than its apical width . . . . *libanius* sp. n.

Spathius striaticeps Cameron (fig. 176).

Meteorus striaticeps Cameron, 1909, *Soc. Ent.* **24** : 108.
Spathius striaticeps Cam., Wilkinson, 1931, *Trans. ent. Soc. Lond.* **79** : 514.

♀. Head blackish or very dark brown; in the latter case the face has a pale reddish tint; pronotum, mesonotum, scutellum and anterior part of the mesopleura blackish like the head; rest of the thorax contrasting reddish-yellow; petiole reddish-yellow; gaster predominantly brown. Legs reddish-yellow throughout.

Head clearly narrower behind the eyes than across them (fig. 174). Face coarsely reticulate-rugose. Frons and vertex transversely and somewhat confluently striated; the striation is much broken up to the sides of the ocelli. Occipital margin angled at middle point above, the surface of the vertex adjacent to the angulation tending to become completely smooth. Antenna broken, flagellum 1 as long as scape plus pedicel.

Thorax: Mesonotum, seen from above, not subtruncate in front, though in profile falling vertically to the pronotum; its surface shining, vaguely rugose-reticulate all over; the reticulate element is more in evidence on the middle lobe while on the lateral lobes there are several oblique rugae; no linear band of fine sculpture on lateral lobes, only an ill-defined longitudinal smooth patch; further, the mesonotum is clothed with numerous fine short hairs in addition to the long ones. Scutellum and postscutellum clothed thickly with short, fine hairs; scutellar shield shining, smooth, except for some obsolete rugosity. Propodeum: basal carina much shorter than its forks, almost wanting; dorsal areas smooth and shining on about basal half; areola sharply defined throughout, confluent with the area petiolaris. Mesopleura covered with rugosities except for a smooth, highly polished medial area; the furrow shallow, strongly costate, its ridges extending as obsolescent carination on to the disc. Hind coxa simple; hairs of the upper surface of the hind tibia about $1\frac{1}{2}$ times its middle width; lobe with 2 spines near the shorter spur; hind tarsus 1 very slightly more than twice 2, 28 : 13 (figs. 169 and 170).

Abdomen: Petiole about $1\frac{1}{2}$ times as long as the propodeum, its dorsal edge in profile strongly curved just anterior to middle. Tergites (2 + 3)–5 sharply margined laterally, the epipleura of these segments thin, membranous, yellowish and with traces of punctation; the epipleura of the true tergites 2 and 3 are partly divided; the sculpture of (2 + 3) consists of very strong smooth striations, the intervals shining and smooth; 4 with a transverse band of fine striation; 5 disproportionately larger than 6, extremely finely punctate and with the merest indication of aciculation laterally. Ovipositor sheaths about as long as thorax plus abdomen.

Length: 4·5 mm. without ovipositor.

BORNEO: Kuching (type locality) (*J. Hewett*); Sandakan, 1 ♀ (*Baker*).

Type in British Museum (Natural History).

Owing to the colour of the thorax, this is a very striking species. It differs, as well as does the form next to be described, from all the other members of the group in the smooth striation of tergite (2 + 3).

Spathius striaticeps Cameron var. **zamboangensis** var. n.

♀. Differs from the nominotypical form as follows :—

Head very distinctly brown with a well-marked yellowish tint beneath; thorax dark brown, nearly black, throughout; petiole same colour as the head; gaster slightly darker than the petiole.

Frons and vertex almost completely smooth; at most the merest trace of striation behind the ocelli. Mesonotum rather more evenly reticulated. Basal carina of the propodeum longer; areola less well defined, there being no limiting ridges present on posterior half. Mesopleura without an extensively smooth area. Petiole rather more slender; gaster a little less broad; tergite (2 + 3) distinctly longer in proportion to its apical width, its striation finer; tergite 6 not so disproportionately larger than 6.

Length : 2·7 mm. without ovipositor.

PHILIPPINES : Mindanao, Zamboanga, 1 ♀ (*Baker*).

Type in U.S. National Museum.

This insect may be only a small example of the form it represents; the disappearance of sculpture on the vertex would be consistent with a diminution in size. It is very closely related to *striaticeps* and the justification for regarding it as a variety of this species rests primarily on colour and the absence of strong striation on the vertex. Even if these differences should be shown later to be due to size, and the name has to be abandoned, the insect will still be of interest as indicating the range beyond Borneo of *striaticeps*.

Spathius myrtilus sp. n.

♀. Pale brown to the naked eye; propodeum and petiole a little darker than the other parts of the body. Hind coxae and hind femora brown throughout; hind tibiae at first sight honey-yellow but on closer examination faintly whitish on about basal third. Palpi whitish-yellow.

Head rather strongly transverse, a little narrower behind the eyes than across them. Face rugulose, with rather feeble transverse elements. Frons and vertex closely smoothly striate but the striation absent on the posterior declivous part of the vertex. Antenna with 41 segments; scape rather long and, seen at its widest, nearly twice as long as wide; flagellum 1 as long as scape plus pedicel. Ocelli in a triangle with base considerably longer than sides.

Thorax : Mesonotum more or less truncate in front, densely clothed with short, adpressed pubescence; lobes dull, finely sculptured, appearing granulated almost everywhere; posterior carinae strong, straight, virtually unbroken. Scutellum flat, dull, sculptured like the mesonotum. Basal carina of the propodeum a little longer than its forks; areola confluent with the area petiolaris, the elongate area thus formed, and the area on each side of it, thickly pubescent; dorsal areas with feeble transverse rugosity but towards base with indication of scaly-reticulation. Mesopleura rugose everywhere. Hind coxa roundly angled at base beneath; hind femur decidedly thick; hairs of the upper surface of the hind tibia about 1½ times its middle width; apical lobe without spines; hind tarsus 1 a little more than twice 2, 16 : 7; 3 a trifle more than half 5; middle tarsus short, segment 1 being twice as long as wide. Recurrens received into the 2nd cubital cell at a distance from the 1st intercubitus equal to about ⅓ its own (recurrens) length.

Abdomen : Petiole short, only a little longer than the propodeum; in profile, quite strongly elbowed at base, its sculpture consisting of a few longitudinal ridges with coarse rugosity between them. Tergite (2 + 3) as long as apically wide, but appearing longer, closely, finely striate-punctate; the longitudinal wrinkles which make up the striate element are very fine and fairly even and are hardly more emphasised than the punctate element between them; tergite 4 rather feebly scaly-reticulate. Ovipositor sheaths about as long as abdomen plus thorax.

Length: 4 mm. without ovipositor.

♂. Like the female, but the hind femur a little more swollen and its coxa almost yellow; hind tibia not swollen on basal half but gradually widened to apex; hind tarsus a little thicker (fig. 171). Size larger, 4·2 mm.

MALAYA: Singapore, 1 ♀, the type (*Baker*). BORNEO: Sandakan, 1 ♂ (*Baker*).

Type in U.S. National Museum.

Spathius myrtilus Nixon var. **niger** var. n.

After a searching examination, I have decided to regard this insect as nothing more than a form of *myrtilus*; it differs from the nominate form as follows:—

♀. Body entirely blackish to the naked eye; the head of the female from Mindanao has a very faint reddish tint but the Basilan female, a smaller insect, has it entirely brownish-red above and contrasting with the dark thorax; the gaster shows faint reddish suffusions restricted mainly to the apical margin of the segments; the underside of the gaster is more or less yellowish. Hind femora dark brown but yellowish broadly along upper surface and narrowly at base.

Vertex shining, smooth except for the merest trace of striation. Longitudinal element in the sculpture of tergite (2 + 3) more strongly emphasised so that the surface is describable as finely longitudinally wrinkled, the intervals rugulose.

Length: 4–5·2 mm. without ovipositor.

PHILIPPINES: Mindanao, Zamboanga, 1 ♀, the type (*Baker*); I. of Basilan, 1 ♀ (*Baker*).

Type in U.S. National Museum.

The differences in sculpture between var. *niger* and *myrtilus* are not of kind but of degree; but apparently not of degree in the same direction, for while the sculpture of the vertex of *niger* decreases in strength by comparison with *myrtilus*, that of the first segment of the gaster increases in strength.

Only more material can finally decide whether the relationship between the two forms is less close than I have assumed it to be.

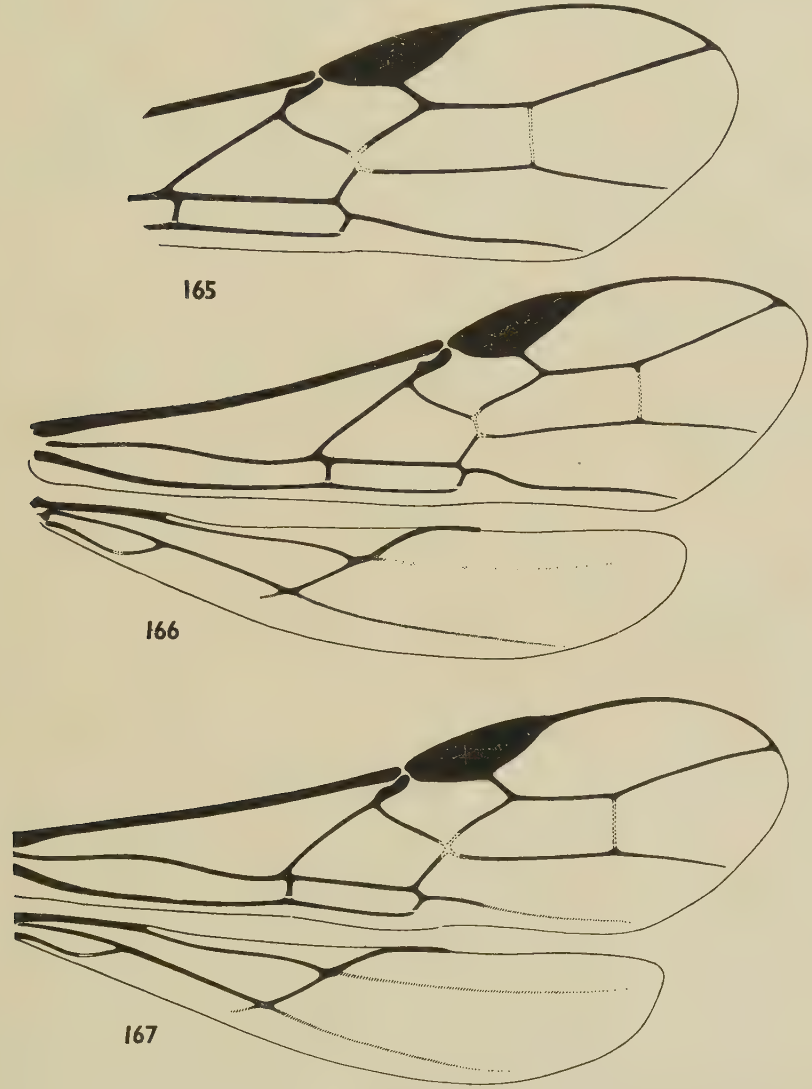
Spathius striolatus Cameron.

Rhacospathius striolatus Cameron, 1905, *Spol. Zeylan.* **3** : 86.
Spathius striolatus Cam., Wilkinson, 1931, *Trans. ent. Soc. Lond.* **79** : 525.

♀. Head, thorax and petiole black; basal ⅔ of tergite (2 + 3) sharply orange-yellow; rest of the gaster very dark brown, nearly black. Palpi pale yellow. All the coxae obscure reddish-yellow, the hind pair darkest; hind tibiae slightly blackened but clear yellowish at extreme base; legs otherwise obscure reddish-yellow.

Head very slightly narrower behind the eyes than across them, 35 : 37. Except along the middle line, which is smooth, the face is strongly transversely striate-reticulate on upper half but becomes confluently striate towards the cheeks. Frons evenly striate. Vertex completely smooth except for a few widely scattered, shallow, not sharp, punctures. Antenna broken.

Thorax: Mesonotum decidedly truncate in front, almost everywhere with strong ruga which leave free on the lateral lobes a narrow band of fine surface sculpture; hairs mostly rubbed off but those which are left sparse, semi-erect. Scutellum nearly smooth, with only a very feeble surface sculpture and with four large shallow punctures against each lateral margin—this may be only an individual characteristic. Propodeum: basal carina about as long as its forks; dorsal areas well defined, shining and with only a feeble sculpture over most of their surface. Mesopleura with much rugosity but becoming smooth against the upper margin of the smooth furrow. Hind coxa subangulate at base; hairs of the upper surface of the hind tibia semi-erect, not quite as long as the middle width of the



Figs. 165–167.—Wings of *Spathius*:—165. *Spathius striolatus* Cameron; 166. *S. philoctetes* sp. n.; 167. *S. pompelon* sp. n.

tibia; apical lobe with a complete row of spines; hind tarsus 1 about twice 2; 3 is $\frac{2}{3}$ of 5; segment 1 of the middle tarsus about $2\frac{1}{2}$ times as long as wide. Wings (fig. 165).

Abdomen: Petiole about twice as long as the propodeum, with strong longitudinal ridges and irregular rugosity. Tergite (2 + 3) and 4 to just beyond the spiracle with a completely differentiated lateral margin; 5 without a differentiated margin though it is very sharply reflexed and appears to have such a margin and its epipleura are thin, membranous and unsculptured; tergite (2 + 3) slightly shorter than its apical width, 37 : 39 and, except for a narrow apical margin, sculptured all over, the sculpture consisting of fine striate-reticulation, the longitudinal elements being irregular, much wrinkled, but not much emphasised; towards the apex of the segment the striate element fades out, leaving extremely fine punctate-reticulation; 4 sculptured like the apex of (2 + 3) but more finely and without a trace of striation; 5 extremely finely closely punctate. Ovipositor sheaths about as long as thorax plus abdomen.

Length: 6·5 mm. without ovipositor.

CEYLON: type ♀ (*Cameron Coll.*).

Type in British Museum (Natural History).

This species is largely characterised by the colour and sculpture of tergite (2 + 3) in combination with the smooth vertex, and by these two features alone it is easily distinguishable from the other members of the group. It is also separable from its allies, though less readily, by having no differentiated lateral margin to tergite 5.

Spathius hephaestus sp. n.

♂♀. Entirely bright brownish-red; front and middle coxae yellowish but the hind pair the same colour as the thorax.

♀. *Head* only very slightly wider behind the eyes than across them, about 31 : 29. Face coarsely and more or less transversely rugose. Frons and vertex with coarse, shining, much wrinkled rugosity which on posterior half of vertex develops into strong, fairly regular, transverse carination. Temples with strong longitudinal carination. Antennal scape rather long, flagellum 1 slightly longer than scape plus pedicel (fig. 173).

Thorax: Mesonotum markedly truncate in front, covered all over with strong, much raised smooth rugae; longitudinal, linear area of the lateral lobes almost smooth, elevated. Scutellum virtually smooth. Mesopleura scored by very strong, in part wrinkly carination everywhere; subalar impression virtually without a trace of pubescence. Propodeum: basal carina about as long as its forks; dorsal areas clearly defined, very shining and almost smooth over most of their medial surface. Hind coxa with a distinct basal projection; hairs of the upper surface of the hind tibia less than twice as long as its middle width, about 8 : 5; lobe prominent, with a complete row of spines.

Abdomen (fig. 168). Petiole twice as long as the propodeum; in the smaller female (Iligan), the petiole is almost smooth except for a few fine longitudinal ridges; in the second female, the type, other rugosities are present but they are decidedly obsolescent. Gaster consisting of three visible segments, the apical segments being hidden beneath tergite 5, twice as long as its greatest width; (2 + 3) about as long as its apical width, finely, closely, longitudinally striated all over, the intervals rugulose; 5 much larger than 6, which it completely hides, very finely transversely striated on about apical half; (2 + 3)–5 with a sharp completely differentiated lateral margin, their epipleura thin, membranous, unsculptured. Ovipositor sheaths about as long as the body.

Length: 6–8 mm. without ovipositor.

♂. Gaster narrowly oval, twice as long as its greatest width, consisting of 3 large segments, sculptured like those of the female; 6 is very short and shows as a narrow, smooth strip at apex. Length: 7 mm.

PHILIPPINES: Mindanao, Surigao, 1 ♀, the type (*Baker*), Iligan, 1 ♀ (*Baker*); Mt. Banahao, 1 ♂ (*Baker*).

Type in U.S. National Museum.

The conformation of the gaster in combination with its colour and sculpture makes this species one of the most distinctive forms of *Spathius* that I know. I am acquainted with no other species with which it could be confused.

Spathius libanius sp. n.

This species differs from *hephaestus* as follows :—

♀. Head reddish; thorax brownish-black with a slight reddish tint on the propleura and sides of pronotum; tergites (2 + 3)–5 much the same colour as the thorax but with a dull reddish apical band. Hind coxae and all the femora brown; front and middle coxae paler in colour than the hind pair, having a yellowish tint; all the tibiae becoming pale at apex but otherwise dark and towards base darker than the corresponding femur. Wings rather strongly darkened. Build stouter than that of *hephaestus*.

Head clearly narrower behind the eyes than across them. Temples in greater part smooth, only a trace of striation medially. Scape shorter, or ordinary form, together with the pedicel equal to the 1st segment of the flagellum.

Thorax: Mesonotum equally rugose but less shining, owing to the presence of a very weak scaly-reticulation which tends to overlie the rugosities, especially of the lateral lobes. Scutellum dull, more or less scaly-reticulate all over. Areola much less well defined, its posterior limits not defined; basal carina clearly shorter than its ill-defined forks; dorsal areas less shining. Legs stouter; apical lobe of the hind tibia considerably over-reached by the shorter spur; this is not so in *hephaestus*.

Abdomen: Petiole slightly less than twice the length of the propodeum, 37 : 20, its surface somewhat smooth, for the most part feebly sculptured and showing an indication of very weak scaly-reticulation. Gaster duller, short and wide, its length to apical width as 24 : 17, its sculpture similar to that of *hephaestus*; tergite 5 with very fine transverse apical aciculation; mid-basally this sculpture breaks up into extremely fine punctation.

Length: 4·7 mm. without ovipositor.

PHILIPPINES: I. of Basilan, 1 ♀ (*Baker*).

Type in U.S. National Museum.

Group of **philoctetes** sp. n.

Spathius philoctetes sp. n.

I put this species next to the *striolatus*-group, though it is probably not very closely related to it; it may be compared with *striolatus* as follows :—

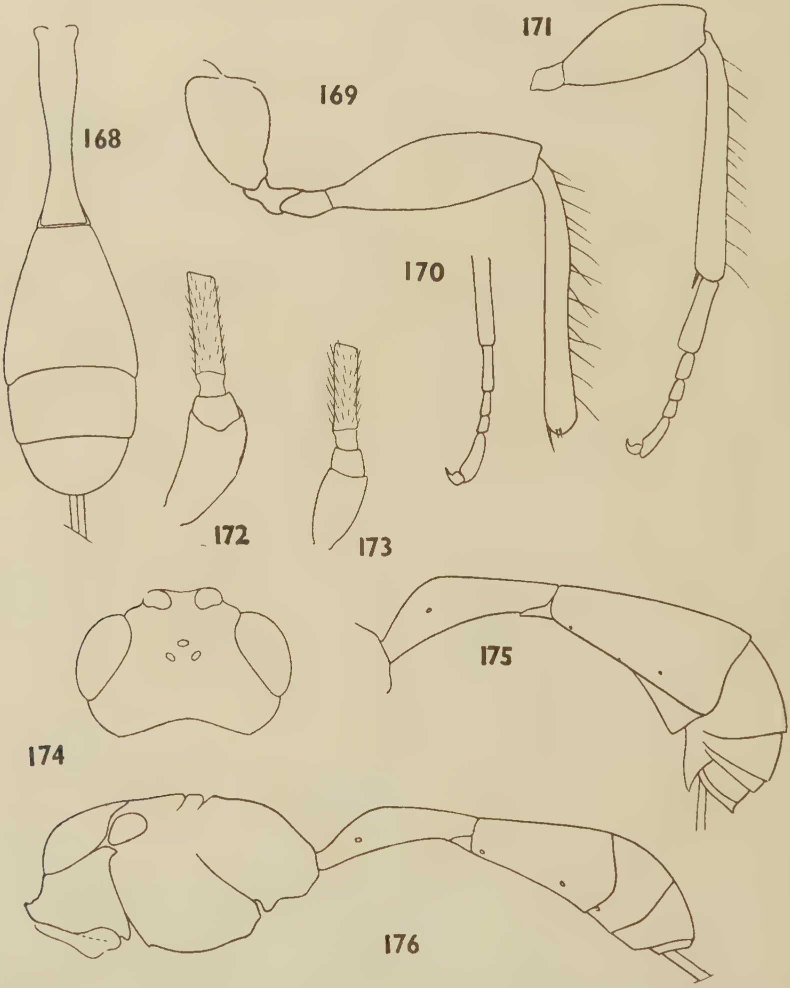
♀. Body entirely pale brownish-yellow. Labial palpi and the 2 basal segments of the maxillary palpi darkened. Antennae dark brown but the flagellum paler towards the base and the scape much the same colour as the head. All the tibiae dark brown, contrasting with the femora which are coloured much like the body but have a reddish tint; coxae same colour as the femora but the trochanters and tarsi approaching the colour of the tibiae.

Sculpture of the face similar but the striate element less in evidence. Head behind the eyes and against the occipital margin with a small area of very weak sulcation. Antenna 53–60-segmented (2 ♀♀), considerably longer than the body; scape rather long (fig. 172).

Mesonotum more shining; the smooth longitudinal band on the lateral lobes shows as a somewhat weal-like elevation; hairs of this sclerite very sparse, semi-erect. Scutellum virtually smooth, without a trace of punctures along the lateral margin. Basal carina

½ to ⅓ as long as its forks; dorsal areas with more rugosity. Mesopleura with subobsolescent rugosity all over. Hind coxa with a more obvious angulation at base; hind tarsus 1 less than twice 2, 17 : 10,; hairs of the upper surface of the hind tibia slightly longer. Wings (fig. 166).

Petiole shorter, stouter, about 1½ times as long as the propodeum. Gaster (fig. 175); tergite (2 + 3) unusually hairy; its sculpture consists of excessively fine punctate-reticulation which fades out apically, leaving a smooth apical margin; 4 without a trace of a differentiated lateral margin. Ovipositor sheaths nearly as long as the whole body.



Figs. 168–176.—168. *Spathius hephaestus* sp. n., abdomen; 169 & 170. *S. striaticeps* Cameron, hind leg, ♀; 171. *S. myrtilus* sp. n., hind leg, ♂; 172. *S. philoctetes* sp. n., 3 basal segments of antenna; 173. *S. hephaestus* sp. n., 3 basal segments of antenna; 174. *S. striaticeps* Cam., head, dorsal; 175. *S. philoctetes* sp. n., abdomen, lateral; 176. *S. striaticeps* Cam., thorax and abdomen, lateral.

Length : 5–5·6 mm. without ovipositor.

Philippines : Mindanao, Iligan, 3 ♀♀, one the type (*Baker*).

Type in U.S. National Museum.

This is a very striking species, unlike any other *Spathius* that I know. It is characterised by colour and by the sculpture and vestiture of tergite (2 + 3).

Group of *spilopterus* Cameron.

Characters: Yellowish-red or brownish-red species. Fore-wing weakly or strongly dappled with black and white; the submedian cell at its narrowest is crossed by a hyaline fascia.

Vertex sculptured. Mesonotum falling fairly steeply to the pronotum. Disc of the mesopleura sculptured. Medius of the fore-wing deeply curved, the submedian cell being a little constricted beyond middle. Gaster somewhat flattened beneath; tergite (2 + 3) with a completely differentiated lateral margin and without longitudinal elements in its sculpture.

MALAYA. BORNEO. Two species.

This group appears to be somewhat isolated and I am not prepared to say what its nearest allies are. The dappled fore-wing, more especially of *decebalus* sp. n., is highly characteristic. In general facies—this applies more especially to *spilopterus*—there is perhaps some resemblance to the group of *striolatus*. The two species can be separated thus :—

(A). Lateral lobes of the mesonotum in far greater part with a fine scaly-reticulate sculpture; disc of the mesopleura finely scaly-reticulate; pronotal keel sharp but medially almost fused with the posterior margin of the pronotum . . . . *decebalus* sp. n.

(B). Lateral lobes in greater part rugose; only a narrow, linear zone of scaly-reticulation present; mesopleura coarsely rugose all over; pronotal keel wanting . . . . *spilopterus* Cameron.

Spathius spilopterus Cameron.

Meteorus spilopterus Cameron, 1909, *Soc. Ent.* **24** : 107, ♀.
Spathius spilopterus Cam., Wilkinson, 1931, *Trans. ent. Soc. Lond.* **79** : 523.

♀. Uniformly yellowish-red with a slight brownish tinge on the gaster. Palpi pale yellow throughout. Antennae yellowish-red but apparently darkened towards apex (broken in type). Legs more or less the same colour as the body but the hind femora and hind tibiae slightly darkened, the latter narrowly whitish at base; tarsi somewhat whitish, except the apical segment which is darkened. Fore-wings somewhat darkened but pale at apex and crossed by a well-marked hyaline fascia at narrowest part of the submedian cell and also pale at the base of the stigma.

Head transverse, slightly narrower behind the eyes than across them. Face rugulose. Frons with fine striation which breaks up into fine rugulosity towards the eye-margin. Vertex transversely striate, the intervals much rugulose so that the surface generally has a glistening appearance. Temples sculptured similarly to the vertex but with less rugulosity between the ridges.

Thorax: Pronotal ridge wanting at least medially. Mesonotum falling steeply but not quite perpendicularly to the pronotum. Mesonotum with much rugulosity; lateral lobes showing only an oblong area of fine sculpture; hairs very sparse, nearly erect. Scutellum scaly-reticulate. Basal carina of the propodeum nearly twice as long as its forks; dorsal areas covered everywhere with fine rugose-reticulation. Mesopleura with raised rugosities everywhere. Nervus parallelus exactly interstitial. Hind coxa roundly angled at base beneath; hind tibia with a complete row of spines at apex; hairs of the upper surface of the hind tibia nearly erect and about as long as its middle width; hind tarsus 1 twice as long as 2.

Abdomen: Petiole about 1½ times as long as the propodeum, 10 : 7. Tergite (2 + 3) dull, very slightly wider apically than its medial length, 17 : 15, with an extremely fine beaded sculpture and also with a completely differentiated lateral margin; 4 also with a sharp, more or less differentiated lateral margin; apical tergites in greater part smooth; in the type they appear almost entirely so but this is due to the sculptured basal part being obscured owing to retraction of the segments; epipleura of the gastral tergites, thin, membranous. Ovipositor sheaths about as long as petiole plus gaster.

Length: 2·6 mm. without ovipositor.

BORNEO: Kuching, 1 ♀, the type (Cameron Coll.).
Type in British Museum (Natural History).

Spathius decebalus sp. n.

♀. Differs from *spilopterus* as follows:—

Pale brownish-red; gaster with a marked yellowish tint to the naked eye. Palpi, except the apical segment of the maxillary palpi, darkened. Antennae pale brownish-yellow, hardly darkened apically. All the tibiae darkened, not pale at base; if anything, slightly darker here; basal segment of the hind tarsus at base and of middle tarsus throughout, whitish. Fore-wing with a much stronger contrast of pale and dark areas than in *spilopterus*, appearing conspicuously dappled to the naked eye.

Head slightly less strongly narrowed behind the eyes than across them. Frons dull, with a very fine, close scaly-reticulate sculpture and with only the merest trace of transverse striation. Vertex sculptured like frons but towards the temples and occiput, the surface in addition to the scaly-reticulation shows fine broken transverse striation. Head behind the eyes sculptured all over, the sculpture consisting mostly of striation parallel to the occipital margin.

Thorax: Pronotal keel sharp, well defined, medially almost fused with the posterior margin of the pronotum. Mesonotum, in profile, less abruptly arched anteriorly; lobes with hardly any raised rugosity, the surface being dull and covered with an even, close, scaly-reticulation, similar to that of vertex; notaulices feebly indicated and the costae which indicate their course, weak; surface of mesonotum at junction of notaulices with a few raised rugosities. Scutellum slightly convex, dull, evenly scaly-reticulate. Dorsal areas of the propodeum almost everywhere with fine scaly-reticulation. Recurrens received into the 2nd cubital cell at a distance from the 1st intercubitus slightly greater than its own length; submedian cell more strongly and abruptly constricted. Hind coxa evenly rounded at base; apical lobe of the hind tibia with 3–4 spines near the shorter spur; hind tarsus 1 twice 2.

Abdomen: Petiole slightly more than 1½ times as long as the propodeum, 15 : 9. Tergite (2 + 3) with a differentiated lateral margin extending to slightly beyond the 2nd spiracle; 4 without a differentiated lateral margin, though being very sharply reflexed it appears to have one; tergite (2 + 3) dull, excessively finely beaded, except for an almost smooth apical margin; following tergites similarly sculptured, but owing to retraction all tergites beyond (2 + 3) present a predominantly smooth surface. Ovipositor sheaths slightly longer than the gaster.

Length: 5 mm. without ovipositor.

MALAYA: Singapore, 1 ♀ (*Baker*).
Type in U.S. National Museum.

This very distinctive species differs at once from *spilopterus* (to which I think it is not very closely related) in size, sculpture of head and of mesonotum and length of ovipositor. Apart from the similarity to *spilopterus*, it is quite unlike any other *Spathius* I know. Were closely allied species available, it would probably be differentiated by the fine scaly-reticulation which covers most of the surface of the head and thorax as well as by the lack of definition of the notaulices and the reduction of strong raised mesonotal sculpture which usually accompanies this lack of definition.

Group of *testaceitarsis* Cameron.

Spathius testaceitarsis Cameron.

Stenophasmus testaceitarsis Cameron, 1908, *Dtsch. ent. Z.* **1908** : 690.
Spathius testaceitarsis Cam., Wilkinson, 1931, *Trans. ent. Soc. Lond.* **79** : 525.

♀. Black, the underside of the head and of the thorax with a brownish tint in the type; the gaster has a purplish-brown tint (type); one female from Pelawan has the gaster as black as the rest of the body; in the other females examined the colour of the abdomen, and to a less extent that of the rest of the body, is variable, being sometimes entirely brown. Antennae markedly yellowish at base. Palpi very pale yellow. Front and middle coxae testaceous yellow; hind coxae black or brownish; femora of all legs same colour as the hind coxae; hind tibiae brown on basal half, then towards apex becoming gradually pale brownish-yellow; this latter colour extends all over the hind tarsi, as in the type; the contrast in colour between the base and apex of the hind tibia is very sharp in the female from Pelawan; in some other females examined the contrast is much less sharp, the hind tibia being only slightly less pale at apex than at base. Stigma of the fore-wing entirely brown.

Head distinctly a little narrower behind the eyes than across them, 34 : 37. Face evenly rugose. Frons transversely striate. Vertex and head behind the eyes smooth, shining, having at most a few setiferous punctures. Antennae very long, slender, with about 60–70 segments; flagellum a little longer than scape plus pedicel, 13 : 10.

Thorax long, narrow. Pronotal keel distinct, but medially almost fused with the posterior margin of the pronotum. Mesonotum falling fairly steeply to the pronotum, but not vertically, clothed with scattered more or less erect hairs; lobes in greater part with only a very feeble surface sculpture; the lateral ones almost smooth; notaulices ill defined, with somewhat obsolete, transverse costae; posterior carinae fairly well defined. Basal carina of the propodeum slightly to considerably longer than its forks; dorsal areas at least medially with a fine surface sculpture but here sometimes almost smooth. Recurrens almost interstitial; nervus parallelus by no means interstitial; stigma narrowly pointed at apex (fig. 8). Front tarsus a little more than 1½ times as long as its tibia, 88 : 53; hind coxa angularly produced at base and here with a trace of a projection; hairs of the upper surface of the hind tibia about twice as long as its middle width; apical lobe with a complete row of spines; segment 1 of the hind tarsus about 3 times as long as 2; 3 very slightly shorter than 5.

Abdomen : Petiole almost twice as long as the propodeum, about 11 : 6. Tergite (2 + 3) nearly 3 times as long as its basal width and nearly 1½ times as long as its apical width, dull, sculptured to apex; very finely reticulate-punctate; on apical half the sculpture becomes slightly more fine; on basal half, more especially towards sides, there is a tendency for feeble longitudinal wrinkles to appear. Following tergites with a fine sculpture similar to that of the apical half of (2 + 3); tergite (2 + 3) with a completely differentiated margin right to apex; 4 margined almost to apex. Ovipositor sheaths almost as long as the body.

Length : 6–9 mm. without ovipositor.

BORNEO : Quop, type ♀ (Cameron Coll.); Sandakan, 2 ♀♀ (*Baker*); Pelawan, [should this not be Pelawan Bazaar?] 1 ♀ (*Walsh*). MALAYA : Singapore, 8 ♀♀ (*Baker*). PHILIPPINES : Mindanao, Butuan, 1 ♀ (*Baker*).

Type in British Museum (Natural History).

I accept as varieties of this species the following forms :—

(1) Gaster brownish-black with a slight purplish tint; petiole markedly reddish. Front and middle coxae deep honey-yellow; hind coxae and hind femora deep reddish; all the tibiae blackish towards apex.

Philippines : Luzon, Mt. Makiling, 1 ♀; Mt. Banahao, 1 ♀ (*Baker*).

(2) Hind coxae much less red than in (1), approaching the colour of the front and middle pairs; all the tibiae not blackened at base though their colour is more intense basally. Petiole not reddish; tergite (2 + 3) conspicuously rust-coloured on basal $\frac{2}{3}$. Length: 8–10 mm.

Philippines : Luzon, Mt. Makiling, 1 ♀ (*Baker*). Borneo : Sandakan, 1 ♀ (*Baker*).

Two small females from Sandakan have the hind coxae hardly different in colour from the other pairs and tergite (2 + 3) of the same colour throughout, but in both examples the entire gaster is brown. These two females probably show the normal change in colour correlated with diminution in size.

In considering such extreme forms as the single female from Pelawan with its intensely black appearance and the striking form mentioned under (1) above, I was much tempted to regard them as specifically distinct from *testaceitarsis*. However, I have been unable to find any structural distinction which could justify a separation.

The important feature of *testaceitarsis* is the long 1st segment of the hind tarsus.

Group of **zamus** sp. n.

Spathius zamus sp. n.

♀. Dark brown; thorax slightly darker than the other parts of the body. Antennae obscure brownish throughout. Palpi yellow. Front and middle coxae and all the trochanters testaceous yellow; legs otherwise brown; in one female, the type, the hind tibiae show a testaceous ring just before the base.

Head slightly narrower behind the eyes than across them, 11 : 12. Vertex and head behind the eyes completely smooth. Ocelli in a triangle with base clearly longer than its sides. Antenna with 57 segments (1 ♀); flagellum 1 very slightly longer than scape plus pedicel.

Thorax : Pronotal keel distinct but medially almost fused with the posterior margin of the pronotum; lateral area distinct, smooth by contrast with the surrounding surface. Mesonotum falling fairly steeply but by no means vertically to the pronotum; its hairs semi-erect, especially along the antero-lateral margins and on the anterior part of the middle lobe where, in addition to the long hairs, there are a number of minute adpressed hairs; sculpture of lobes in greater part fine, indefinite, the surface shining; posterior carinae with short lateral branches. Propodeum : dorsal areas in greater part almost smooth, strongly shining; basal carina about as long as its forks or a little longer; areola and lateral areas rather thickly pubescent. Disc of the mesopleura almost polished, at most a few obsolescent rugosities present. Legs : front tarsus not much longer than its tibia, 5 : 4; hind coxa with a small tooth-like projection at base; hairs of the upper surface of the hind tibia hardly $1\frac{1}{2}$ times as long as its middle width; apical lobe with a complete row of spines; hind tarsus 1 very slightly more than twice 2, 11 : 5; 3 shorter than 5, 7 : 9. Recurrens nearly interstitial; nervus parallelus by no means interstitial.

Abdomen : Petiole slightly more than twice the length of the propodeum, with widely separated longitudinal ridges, except at apex, which is, as usual, predominantly striated, the intervals rugulose. Tergite (2 + 3) distinctly longer than its apical width, margined laterally but the margin not completely differentiated beyond the 2nd spiracle; this segment is divided by a difference in sculpture into two ill-defined areas of equal length, the basal one of which appears finely beaded owing to the presence of minute shining points (describable also as minutely rugose-punctate); the apical area is more weakly sculptured and hence more shining; broad apical margin almost smooth. Following tergites almost smooth, at most with some microscopically fine punctation. Tergite 4 without a trace of a lateral margin. Ovipositor nearly as long as the whole body.

Length: 7 mm. without ovipositor (type); 2nd female, 6 mm.

PHILIPPINES: Mindanao, Butuan, 1 ♀, the type (*Baker*); Kolambugan, 1 ♀ (*Baker*).

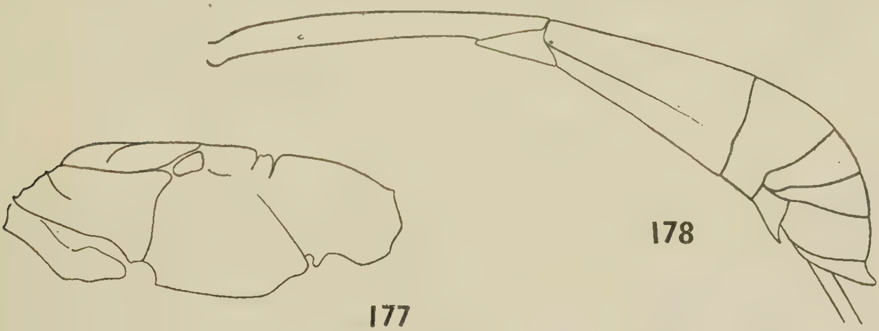
Type in U.S. National Museum.

This species is closely related to *testaceitarsis* Cameron, differing from it only in having the basal segment of the hind tarsus shorter in proportion to the 2nd and by having tergite 4 without a differentiated lateral margin.

Group of **metrodorus** sp. n.

Spathius metrodorus sp. n.

♀. Head and thorax bright reddish-brown; propodeum in the type slightly darkened above; petiole and gaster dark brown. Flagellum blackish. Middle and front legs unicolorous, much the same colour as the head; hind coxae, hind trochanters and hind femora dark brown; hind tibiae at base slightly paler than their femora but becoming still paler towards apex.



FIGS. 177–178.—*Spathius metrodorus* sp. n., thorax and abdomen, lateral.

Head slightly narrower behind the eyes than across them. Face mostly transversely rugose with a medial longitudinal elevation which is smoother than the surrounding surface. Frons striate. Vertex and temples completely smooth. Base of the ocellar triangle slightly longer than its sides. Antenna broken; flagellum 1 a little longer than scape plus pedicel, 16 : 13.

Thorax long and narrow (fig. 177). Pronotum unusually smooth; pronotal keel strongly developed, smooth, sharp, free; lateral areas almost smooth in the type but with a few obsolete, transverse ridges in the 2nd female. Mesonotum sloping gradually to the pronotum; its lobes shining and with an excessively fine, subscaly-reticulate sculpture; notaulices deeply costate; posterior carinae close together, parallel, long and wrinkly. Basal carina of the propodeum about 1½ times as long as its forks; dorsal areas becoming scaly-reticulate over most of their medial surface. Mesopleural furrow costate; disc shining, with fine scattered punctures; subalar impression finely pubescent, with a few longitudinal rugae in the type, but nearly smooth in the 2nd female. Fore-wing as in *testaceitarsis* (cf. fig. 8); recurrens virtually interstitial; nervus parallelus by no means interstitial; 1st abscissa of the medius of the hind-wing very short. Front tarsus more than 1½ times as long as its tibia, about 5 : 3; hind coxa more or less evenly rounded beneath at base; hairs of the upper surface of the hind tibia about 1½ times as long as its middle width; apical lobe with a complete row of spines (6); hind tarsus 1 a trifle more than twice 2, 40 : 19; 3 is as long as 5.

Abdomen long, narrow (fig. 178). Petiole nearly 3 times as long as the propodeum, not elbowed at base in profile. Tergite (2 + 3) fully twice as long as apically wide, sharply margined laterally as far as the 2nd spiracle; its sculpture consists of extremely fine, even, more or less granular rugosity; 4 without a trace of a margin; following tergites less dull and with a finer sculpture than (2 + 3). Ovipositor sheaths rather wide, fully as long as the whole body.

Length: 10–11 mm. without ovipositor.

♂. Like the female, but has the antenna 69-segmented (2 ♂♂). Gaster very slender, about 6 times as long as wide.

Borneo: Sandakan, 3 ♂♂, 2 ♀♀ (1 ♀, the type) (*Baker*).

Type in U.S. National Museum.

This species appears to have no close allies. It is, I think, most closely related to *zamus* sp. n. on account of the form of the gaster. Specifically it is very distinct because of its bright head and thorax and dark abdomen and I know of no other species of *Spathius* which has the lower basal cell of the hind-wing so short.

S. metrodorus, *zamus* and *testaceitarsis* all have the same type of abdomen but the two last mentioned species have the gaster shorter than in *metrodorus*.

Group of *scotti* Wilkinson.

Spathius scotti Wilkinson.

Spathius scotti Wilk., 1931, *Trans. ent. Soc. Lond.* **79** : 523 (fig.).

♀. Head black; thorax red with the pronotum more or less honey-yellow and the following parts blackened :—2 lateral lobes of the mesonotum (to a less extent the middle lobe and in any case the course of the notaulices remaining pale), mesopleura (except below the wing insertions), mesosternum and sometimes the dorsal areas of the propodeum; petiole blackish with or without a reddish tinge; gaster yellow-brown to red-brown with a narrow band at apex of (2 + 3) and the whole of tergites 6–8 (except the hidden part of 6) more or less honey-yellow; underside of the gaster yellowish. All the coxae and trochanters bright yellowish; hind femora infuscated; front and middle pair almost yellow; all the tibiae, except at extreme base, brownish; all the tarsi brown, darker than their tibiae, more especially the hind pair. Palpi pale whitish-yellow. Wings faintly but uniformly fuscous; stigma brown, not paler at base.

Head a little narrower behind the eyes than across them (fig. 179). Face, especially on each side of the medial elevation, rather closely rugose-reticulate, the transverse element not being emphasised except towards the cheeks where the sculpture becomes more shining. Frons with faint indication of striation on each side of the middle line. Vertex smooth and shining. Antenna with 47 segments (1 ♀); flagellum 1 a trifle shorter than scape plus pedicel, 11 : 12; hairs of the more basal flagellar segments dense, rather pale, considerably shorter than the width of the segments. Ocelli in a triangle with base a little longer than sides.

Thorax: Pronotal keel well defined, but not raised above the level of the posterior margin of the pronotum, from which it is clearly separated; lateral area fairly well defined, shining, transversely ribbed. Mesonotum sloping rather abruptly to the pronotum; lobes predominantly finely sculptured, but the scaly-reticulation much broken down and showing transverse tendencies; posterior carinae usually fused to form a single carina

(1 ♀, 5 ♂♂); in a single large ♀, the ridges are separate but almost contiguous; costae of the foveolate notaulices rather fine; mesonotal hairs very sparse, semi-erect. Scutellum almost flat, becoming smooth and shining medially; anterior depression divided by a ridge into 2 large subquadrate hollows in each of which are a number of irregular rugae. Propodeum somewhat elongate; basal carina very long, reaching to middle; areola virtually not defined, its outline lost amidst irregular reticulation; dorsal areas longer than wide, shining, with a subobsolescent sculpture of extremely fine punctate-reticulation, at least on anterior half. Mesopleura smooth and shining all over the disc; the furrow evenly foveate. Legs: hind coxa rounded at base beneath; hind femur rather short and stout; hairs of the upper surface of the hind tibia rather uneven in length, the longest of them a trifle longer than its middle width; lobe without spines in one female, but 3 near the shorter spur in the 2nd female; hind tarsus 1 less than twice 2, 9 : 5; 3 is $\frac{3}{4}$ of 5. Recurrens almost interstitial; nervus parallelus by no means interstitial.

Abdomen: Petiole long, narrow, twice as long as the propodeum; in profile not elbowed at base, reticulate-punctate and without prominent longitudinal elements, except within the apical dilatation. Gaster twice as long as wide; tergite (2 + 3) with a sharp, completely differentiated margin extending to as far as the 2nd spiracle; its sculpture somewhat vague; on apical half it consists of very fine, broken, predominantly transverse, striation and on basal half of longitudinal striate-punctation; there is no sharp line of demarcation between the two types of sculpture and laterally the striation tends to be longitudinal on both halves; tergite 4 with obsolescent transverse aciculation; following tergites almost smooth. Ovipositor sheaths as long as the whole body.

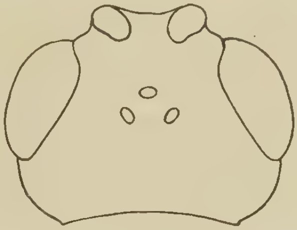


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FIG. 179.—*Spathius scotti* Wilkinson, head, dorsal.

Length: 5–6 mm. without ovipositor.

♂. Like the female except for the sexual differences. Length: 2·8–4·5 mm.

SEYCHELLES: Mahé; Silhouette (*H. Scott*).

Type in British Museum (Natural History).

This is quite a strikingly coloured species, the pale yellowish pronotum being perhaps its most salient colour feature. Its affinities seem to be doubtful; in general facies, there is a resemblance to *testaceitarsis* Cam., but I am inclined to regard the similarity as merely superficial. Between Cameron's species and *scotti*, there is a striking difference in the length of the 1st segment of the hind tarsus in relation to the 2nd.

Group of *trochanteratus* Szepligeti.

Spathius trochanteratus Szepligeti.

S. trochanteratus Szep., 1914, *Mitt. zool. Mus. Berl.* **7** : 193, ♀.

♀. Head honey-yellow with a faint brownish tinge chiefly behind the eyes; mesonotum dingy yellow, the same colour bordering the sides of the pronotum above; thorax otherwise brown, the upper surface of the propodeum showing a faint reddish suffusion; gaster above brown, the petiole darker; ventral surface of the gaster yellow almost everywhere. Antennae brown, approaching the head-colour towards base. Palpi whitish-yellow. Front and middle coxae honey-yellow; hind coxae brownish but becoming almost yellowish above and below; hind femora brown, honey-yellow at base; middle and front femora much more extensively yellow, the brown colour being restricted to a faint cloud along the dorsal surface and an elongate patch on each side near apex; hind tibiae honey-yellow, with a faintly darker postbasal band. Stigma becoming pale on about basal $\frac{2}{5}$.

Head considerably narrower behind the eyes than across them. Face with very fine, broken transverse striation mixed with scaly-reticulation on either side of the nearly smooth medial elevation. Frons finely striate. Vertex completely smooth. Ocelli in a triangle with base very slightly longer than sides. Antenna very long and slender, broken, but with at least 48 segments; flagellum 1 as long as scape plus pedicel; flagellum clothed with rather bristly hairs which, at least on 4 basal segments, are fully $\frac{3}{4}$ as long as the width of the segments; towards apex of flagellum they are still longer.

Thorax: Pronotal keel well separated from the posterior margin of the pronotum and lying below it; lateral area not delimited posteriorly, crossed by strong ribs. Mesonotum falling fairly abruptly to the pronotum, its hairs very long, sparse and outstanding; its sculpture, almost everywhere, consists of fine close scaly-reticulation; notaulices well defined; posterior carinae well defined, smooth, straight. Scutellum almost flat, scaly-reticulate, its anterior depression divided into six, rather irregular elongate foveae. Propodeum: basal carina longer than its rather ill-defined forks; lateral bounding keels of the dorsal areas poorly defined; dorsal areas themselves with obsolescent ridges arising posteriorly and fading out anteriorly in the prevailing scaly-reticulation; areola completely undefined, its place taken by coarse reticulations; area petiolaris well defined, slightly transverse. Mesopleural furrow somewhat shining, with a few very weak costulae; disc dull, everywhere scaly-reticulate; subalar impression with strong longitudinal rugosities. Legs: hind coxa roundly angled at base beneath, scaly-reticulate, almost shagreened; hairs of the hind tibia very long, almost erect, 3 times as long as its middle width; apical lobe with 5 spines; hind tarsus 1 slightly more than twice 2; 3 a little less than $\frac{2}{3}$ of 5, 7 : 12. Recurrens received into the base of the 2nd cubital cell at a distance from the 1st intercubitus equal to about $\frac{1}{3}$ its own length; nervus parallelus not interstitial.

Abdomen: Petiole a little less than twice as long as the propodeum, rather evenly striate but the intervals between the ridges decidedly rugulose. Tergite (2 + 3) with a sharp lateral margin reaching almost to the 2nd spiracle; the surface of this segment, apart from the sharply discrete smooth apical margin, extremely finely striate-punctate. Following tergites progressively more finely rugulose-punctate at base. Ovipositor sheaths a little longer than abdomen plus propodeum.

Length: 6 mm.; ovipositor 4·5 mm.

W. Africa: Spanish Guinea, Uelleburg, vi–viii.1908, 1 ♀ (*G. Tessman*).

Type in Zoological Museum, Berlin.

The specimen on which the above description is based bears the label "*Spathius trochanteratus* m." in Szepligeti's handwriting and I regard it as the type although it is not labelled as such. In recording the locality-data of this species, Szepligeti omitted the place name "Uelleburg".

The affinities of *Spathius trochanteratus* seem to me to be obscure, though the insect is in no way particularly striking. Certainly its colour is rather characteristic: I am thinking of the pale yellowish mesonotum and the yellow ventral surface of the gaster in combination with the darker parts of the body; characteristic also is the presence of the scaly-reticulate ground sculpture on dorsal areas of propodeum, metapleura and mesopleura and on the petiole as rugulosity between the ridges.

Group of **philotas** sp. n.

Spathius philotas sp. n.

♀. Yellowish-brown to reddish-brown, suffused with darker colouring; head pale brownish-yellow, palest on face and with a contrasting brownish suffusion between the eye and the mandible; thorax reddish-brown; middle lobe of the mesonotum and the inner margin of the lateral lobes yellowish; petiole and gaster more or less reddish-brown. Antennae yellowish basally. Palpi almost white. All the coxae yellow; middle and hind femora reddish-brown; the front pair paler; middle and hind tibiae brownish, yellow on about basal $\frac{1}{3}$.

Head rather strongly transverse, very slightly narrower behind the eyes than across them. Face weakly rugulose, smooth to the sides of the clypeus. Frons and vertex dull, finely rugose; there is a trace of striation on the frons, running across the rugulosity. Ocelli arranged exactly in an equilateral triangle. Antenna 26-segmented; flagellum slender; flagellum 1 very slightly longer than scape plus pedicel, 10 : 9, covered with fine hairs on its inner curved side.

Thorax: Pronotal keel feeble, widely fused medially with the posterior margin of the pronotum and hence visible only laterally; lateral area defined. Mesonotum falling almost vertically to the pronotum, covered, but not evenly, with short, recumbent hairs, mixed with longer, outstanding ones; middle lobe somewhat glistening, extremely finely reticulated, the meshes being distinctly raised; lateral lobe slightly more sculptured; notaulices deep, rugose, converging on to a strongly rugose area; posterior carinae not defined. Scutellum hardly convex, dull, appearing evenly beaded. Postscutellum in profile with an extremely feeble dentiform process. Propodeum completely areated, but the ridges feeble and irregular; this applies especially to the forks of the basal carina; dorsal areas covered with unbroken reticulation but scaly-reticulate anteriorly; area petiolaris closed above. Mesopleura rugulose all over. Legs: hind coxa with a feeble projection at base; hairs of the upper surface of the hind tibia hardly as long as its middle width; apical lobe with a complete row of spines. Nervus parallelus not interstitial; medius almost straight; 2nd abscissa of the radius hardly longer than the 1st intercubitus.

Abdomen: Petiole $1\frac{1}{2}$ times as long as the propodeum; fairly stout, striate-reticulate over most of its medial surface. Tergite (2 + 3) showing an ill-defined basal area of fine shining punctate-reticulation; apical to the area the sculpture is finer but towards apex itself fades out, leaving a broad smooth margin; sides of tergite (2 + 3), especially in apical half, broadly smooth and shining. Ovipositor sheaths as long as the gaster.

Length: 2·7 mm. without ovipositor.

PHILIPPINES: Luzon, Mt. Makiling, 1 ♀, the type (*Baker*).

Type in U.S. National Museum.

This species is chiefly characterised by the sculpture of the vertex, contrasting dark lateral lobes of the mesonotum in combination with the yellow, armed hind coxae. It seems to be isolated. Because of the rather glistening sculpture of the mesonotum and the finely rugulose vertex, it bears a superficial resemblance to *caicus* of the *ruficeps* group, but differs from that species, *inter alia*, in the length and vestiture of the 1st flagellar segment and in having armed hind coxae.

Group of *pleuralis* Szepligeti.

Spathius pleuralis Szepligeti.

Spathius pleuralis Szep., 1914, *Mitt. zool. Mus. Berl.* 7 : 193, ♀.

♀. Deep brown but with a dull reddish tint; gaster blackish; the mesopleural furrow shows as a dull red band between the much darker central area and the mesosternum; in the ♀ from Uganda, the propodeum and petiole are decidedly reddish to the naked eye and the thorax generally is paler by comparison with the gaster than in the type. Palpi blackish. Except for the middle coxae, which have a yellowish tint, the legs are much the same colour as the thorax; in the type, however, the tibiae are decidedly darker than their femora. Fore-wings blackish, hyaline at tip and with a narrow hyaline fascia just beyond middle, cutting the base of the stigma; nearly hyaline at base but with no fascia across the middle of the median cell.

Head transverse, not wider behind the eyes than across them. Face with weak, more or less transverse rugulosity on a ground sculpture of excessively fine subscaly-reticulation, almost granulation. Frons dull, finely rugulose all over. Vertex with fine striation on a ground sculpture of fine rugulosity; the ground sculpture is more in evidence towards eye-margin in type, but all over in 2nd female. Similar sculpture occurs on temples and cheeks. Base of ocellar triangle much longer than sides. Antenna broken but with at least 46 segments; flagellum 1 longer than scape plus pedicel, 7 : 5.

Thorax: Pronotal keel very faintly indicated, almost absent, medially close to, but not touching, the posterior margin of the pronotum; lateral area defined as a scaly-reticulate impression. Mesonotum almost bare, falling rather gradually in type, but almost vertically in the 2nd female, to the pronotum; on the whole rather dull, but more shining on lateral lobes posteriorly; lobes in far greater part subscaly-reticulate; notaulices deep and broad but with only very feeble transverse costae; posterior ridges obscured by pin in type, but extending slightly beyond middle, strong, unbroken, straight, in 2nd female. Scutellum rather strongly convex. Basal carina of propodeum distinct to half-way; no trace of an areola, the posterior half of the propodeum being covered with rather strong, mostly transverse rugae, which show a tendency to form a much-broken reticulation; these rugosities are covered with the surface sculpture which occurs on the dorsal areas; the latter not closed posteriorly, defined by a large tract, slightly longer than wide, of subscaly-reticulation. Metapleura covered with very even transverse striation, the interstices roughened; furrow against the anterior margin almost smooth (fig. 180). Mesopleura dull, sculptured all over; subalar impression virtually bare, with even striations which rise over the upper part of the disc and extend downwards, though much weakened, towards the middle coxa; furrow almost obliterated; the disc scaly-reticulate, almost rugulose. Hind coxa simple; hairs of the upper surface of the hind tibia considerably shorter than its middle width, 3 : 5; apical lobe with a complete row of spines; hind tarsus 1 twice 2; 3 as long as 5. Medius deeply sinuate; nervus parallelus interstitial (fig. 181).

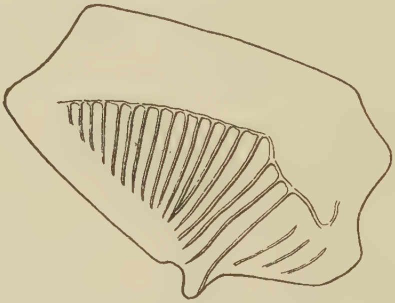

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Fig. 180.—*Spathius pleuralis* Szepligeti, metapleura.

Abdomen: Petiole nearly twice the length of the propodeum, rather strongly narrowed beyond the spiracles, very finely rugose all over, and with no obvious longitudinal element in the sculpture, except for indication of feeble wrinkles on the dilated apical part. Gaster evenly ovate, a little less than twice as long as wide; tergite (2 + 3) slightly shorter than its apical width; an area occupying slightly more than basal $\frac{1}{3}$ is minutely punctate-reticulate and by being less shining, is sharply marked off from the rest of the tergite; surface beyond the area somewhat similarly sculptured but more shining and with a distinct though feeble element of transverse aciculation towards and along the apical margin of the segment: no trace whatever of a lateral margin, the sculpture of the tergite merging imperceptibly into that of its epipleura; sculpture of epipleura of tergite (2 + 3) similar to that of the dorsal surface of the tergite but the aciculation much more in evidence and more or less longitudinal. Following tergites similarly but more finely sculptured. Ovipositor sheaths fully as long as gaster plus petiole.

Length: 6–7 mm. without ovipositor.

AFRICA: N. Kamerun, Jöh, Albrechtshöhe, 31.iii.–7.iv.1906, type ♀ (*L. Conradt*); Uganda, Nambadzidza, 16.i.1927, 1 ♀ (*G. R. L. Hancock*).

Type in Zoological Museum, Berlin.

What I take to be the type female, though not labelled as such, was lent to me by Dr. H. Bischoff; it bears the correct locality data and a label "*pleuralis*" in Szepligeti's handwriting.

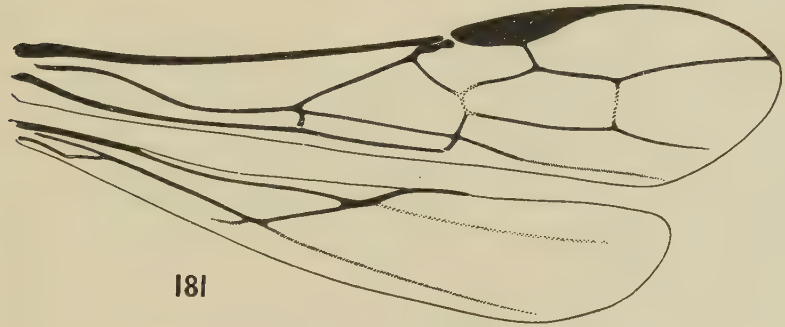


FIG. 181.—*Spathius pleuralis* Szepligeti, wings.

This is an isolated and extremely distinctive species and is characterised by colour of body and wings, almost bare thorax and sculpture of vertex, of metapleura and of tergite (2 + 3).

Group of *dissors* Wilkinson.

Predominantly brown species. Flagellum darkened at apex but with the remaining segments yellowish, ringed with black at apex. Palpi blackened, except sometimes the apical segment of the maxillary palpi. All the femora brownish throughout; hind tibiae sometimes brownish or blackish throughout, at most pale at extreme base (about basal sixth); front and middle tibiae pale at least at extreme apex. Fore-wings usually strongly darkened, marked with hyaline spots and bands (figs. 182–185).

Head not or only a little narrower behind the eyes than across them. Face without differentiated aciculation such as occurs in the group of *rusticulus* Wilkinson. Thorax in a lateral view rather strongly narrowed towards the posterior end. Dorsal surface of the mesonotum without raised sculpture posteriorly except in *gylippus* sp. n. and *siculus* sp. n.; other species sometimes show a single fine ridge here; hairs of the mesonotum always very sparse; notaulices more or less obliterated on the disc, except in *gylippus* and *siculus*, the lobes hence not defined as separate convexities. Propodeum without clearly defined areation, except in *siculus*. Hind coxa with at most a feeble dentiform projection beneath; apical lobe of the hind tibia with a complete row of spines. Except in *dissors* Wilkinson, the submedian cell is always strongly constricted just beyond middle. At least tergite (2 + 3) with a very fine, even sculpture in which there is no trace of longitudinal elements. Ovipositor of the female never longer than the whole abdomen.

AFRICA and INDO-AUSTRALIAN REGION. Nine species.

Key to the species of the *dissors* group.—Females.

1. Medial lobe of the mesonotum sharply, angularly truncate in front, the base of the truncature lying a little posterior to its apex, the truncature itself flat or a little concave (fig. 189); (mesonotum posteriorly with a considerable amount of raised sculpture) . . . . *siculus* sp. n. (p. 348).

–. Medial lobe of the mesonotum not thus modified . . . . 2.

2. Vertex with a predominating sculpture of scaly-reticulation. (Sp. with the submedian cell narrowed towards apex but not constricted) *dissors* Wilkinson (p. 342).

–. Vertex either completely smooth or with transverse aciculation or fine, smooth striation . . . . 3.

3. Scutellum with a conspicuous longitudinal keel; pronotal keel medially free . . . . *antisthenes* sp. n. (p. 346).

–. Scutellum without a trace of a keel, at most a little convex longitudinally; pronotal keel medially fused with the posterior margin of the pronotum . 4.

4. Mesonotum behind without raised sculpture, at most a single weak medial ridge present; notaulices more or less obliterated as such or their course at any rate never defined by raised rugosities . . . . 6.

–. Mesonotum behind usually with a considerable amount of raised sculpture, there being present at least small raised rugosities which mark the course of the well-defined notaulices. (Spp. with the hind tibiae always whitish-yellow at base) . . . . 9.

6. Mesonotum falling almost perpendicularly to the pronotum; tergite (2 + 3) and its epipleura dull, all over with an excessively fine, indefinite sculpture; hind coxae yellowish except for a brown apex . . . . 7.

–. Mesonotum sloping very gradually to the pronotum; epipleura of tergite (2 + 3) much more shining than, and differently sculptured from, the dorsal surface of the tergite; hind coxae brown all over . . . . . . 8.

7. Head very short behind the eyes; vertex with a steep posterior face angularly separated from the dorsal face . . . . . . *vindicius* sp. n. (p. 349).

–. Head not at all short behind the eyes; vertex not thus modified *gelleus* sp. n. (p. 347).

8. Postscutellum in profile flat and forming a continuous line with the scutellum . . . . *zagreus* sp. n. (p. 344).

–. Postscutellum in profile showing as a sharp dentiform projection *calacte* sp. n. (p. 345).

9. Posterior carinae of the mesonotum well defined *gylippus* sp. n. (p. 350).

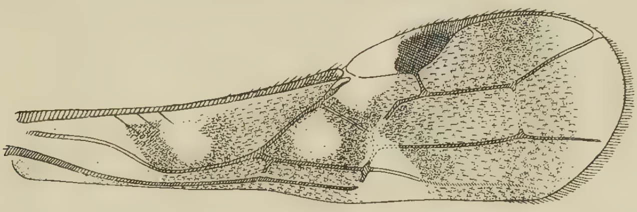
–. Posterior carinae of the mesonotum completely undefined, only a single medial, wrinkly ridge being present . . . . *tros* sp. n. (p. 348).

Spathius dissors Wilkinson.

Spathius dissors Wilkinson, 1931, *Trans. ent. Soc. Lond.* **79** : 511, ♂♀.

♀. Brown, the head and mesonotum sometimes with a faint yellowish tinge (Wilkinson says "dark red, approaching red-black" which to me is distinctly misleading; I have seen the specimens from which he described the species). Palpi blackish.

Front coxae honey-yellow; middle coxae and basal half of the hind coxae (sometimes entire ventral surface of the hind coxae) whitish-yellow; apical half of the hind coxae brown; all the tibiae brown but sharply whitish at extreme base, the front and middle pair



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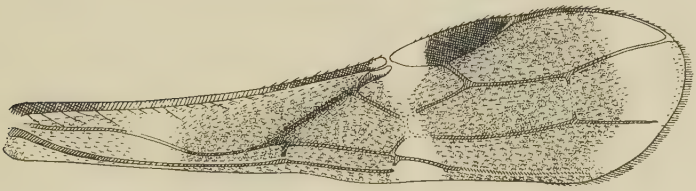

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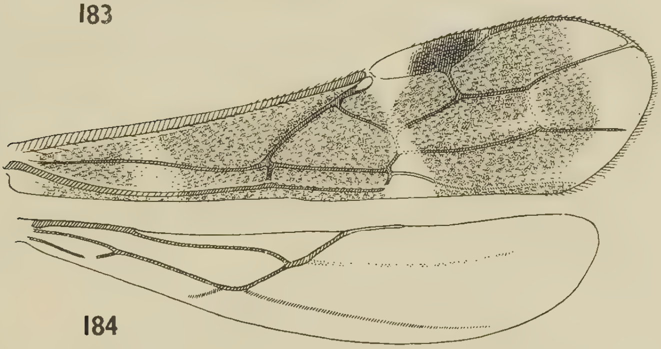

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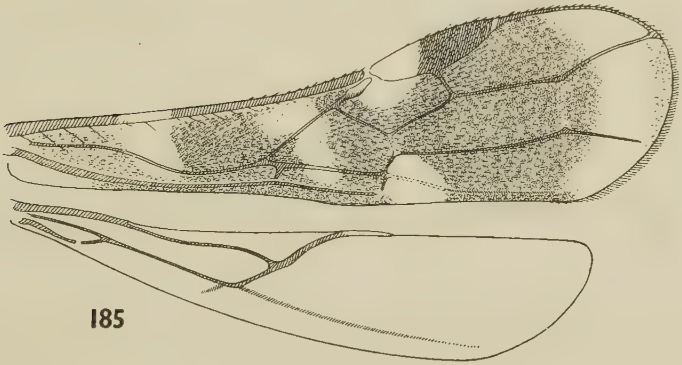

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Figs. 182–185.—Wings of *Spathius*:—182. *Spathius vindicius* sp. n.; 183. *S. gylippus* sp. n.; 184. *S. dissors* Wilkinson; 185. *S. zagreus* sp. n.

also whitish at apex; all the tarsi brownish but the basal segment whitish on about basal half. Fore-wing deeply infuscated, marked with hyaline areas as in fig. 184.

Head as wide behind the eyes as across them, sometimes a little wider. Face with a predominating sculpture of scaly-reticulation and with rather indistinct punctures separated by about two diameters, medially with a weakly raised area extending from the clypeus to the antennal insertions. Clypeus sharply delimited laterally. Frons with weak striation which fades out towards the eye-margin, giving place to scaly-reticulation. Vertex dull, scaly-reticulate; posteriorly the reticulation breaks up to form delicate transverse roughened striation. Head behind the eyes more or less scaly-reticulate. Antenna with 34–40 segments (usually nearer 40); flagellum 1 a little longer than scape plus pedicel, 7 : 6; hairs of the more basal segments very short and inconspicuous. Ocelli arranged in a triangle whose base is only very slightly longer than its sides. Eyes somewhat small, their longer axis twice as long as the malar space.

Thorax: Pronotal keel virtually undeveloped; lateral area poorly developed, its surface predominantly scaly-reticulate. Mesonotum sloping rather gradually to the pronotum, scaly-reticulate all over; no trace of raised sculpture posteriorly; notaulices completely obliterated on the dorsal surface of the mesonotum. Scutellum decidedly convex, scaly-reticulate, its anterior depression rather shallow, weakly foveate. Postscutellum in profile with a blunt dentiform projection. Propodeum unareated; basal carina feebly indicated; no areola; most of the dorsal surface scaly-reticulate, merging into fine rugosity posteriorly. Mesopleura scaly-reticulate everywhere, the subalar impression and the furrow without raised rugosities; sometimes the merest trace of fine striation in the latter. Legs: hind coxa with a very feeble basal projection; hairs of the upper surface of the hind tibia sparse, almost recumbent, about half the middle width of the tibia; apical lobe with a complete row of about 8 spines; hind tarsus 1 a little more than twice 2, 9 : 4; 3 is $\frac{3}{4}$ of 5. Fore-wing: 1st abscissa of the radius placed almost at right angles to the 2nd; 2nd a little shorter than the 1st transverse cubitus; submedian cell narrowed but not constricted at apex (fig. 184); hairs present on the narrowed proximal part of the median cell.

Abdomen: Petiole about $1\frac{2}{3}$ times as long as the propodeum, predominantly scaly-reticulate with weak longitudinal ridges, more especially towards sides and apex; gaster dull, its entire surface, dorsal and ventral, covered with an excessively fine, granulate sculpture, giving the surface an opaque appearance. Ovipositor sheaths about as long as the whole abdomen.

♂. Like the female except for the sexual differences.

Length: ♂♀, 3–5 mm. without ovipositor of female.

SOUTH AFRICA: Pondoland, Port St. John (*R. E. Turner*).

Type in British Museum (Natural History).

This species differs chiefly from the other members of the group in having the medius of the fore-wing less curved and the vertex differently, indeed quite characteristically, sculptured.

Spathius zagreus sp. n.

♀. Brown. Antennae more or less yellow, the segments very faintly ringed with brown at apex, but the apical segments becoming entirely brown. Apical segment of the maxillary palpi whitish. Front and middle coxae and the basal trochanter of the hind leg pale yellowish; extreme base of the hind tibia slightly, though abruptly, pale; front and middle tibiae pale at apex; hind tibiae clearly darker than their femora.

Head very slightly narrower behind the eyes than across them. Face with fine, slightly broken transverse striation; this sculpture tends to be interrupted along the middle line. Frons with a patch of fine aciculation on each side. Vertex with distinct traces of fine transverse broken or wavy aciculation, absent to sides of ocelli and on temples. Head behind the eyes virtually smooth. Base of the ocellar triangle clearly a little longer than its sides. Antenna broken; flagellum 1 a little longer than scape and pedicel, 5 : 4.

Thorax: Pronotal keel widely fused medially with the posterior margin of the pronotum. Mesonotum sloping gradually to pronotum (fig. 190), no indication of raised sculpture on its posterior part, its sculpture consisting of delicate scaly-reticulation; lobes not indicated as separate convexities; notaulices indicated clearly only anteriorly; on the disc they are barely defined and then only by a slight roughening of sculpture; very few hairs, and these restricted to the course of the notaulices more or less. Scutellum fairly strongly convex, evenly scaly-reticulate. Postscutellum without a trace of a median dentiform process, hence appearing flat in profile and continuing the line of the scutellum. Propodeum dull, with some sort of sculpture all over; dorsal areas barely indicated, the surface between them covered with roughened scaly-reticulation; costulae distinct in the type as is likewise the basal carina; virtually absent in the smaller female (Malinao); areola feebly indicated posteriorly by two carinae, its surface shining and weakly transversely carinate. Mesopleura with a broad, virtually smooth shining area extending across the middle; posteriorly this area cuts off a subtriangular area of dull scaly-reticulation. Wings (fig. 185); hairs present on narrowed proximal part of median cell. Legs: hind coxa with the merest trace of a basal projection, showing as a blunt angulation; segment 1 of the middle tarsus about 3½ times as long as wide; segment 1 of the hind tarsus twice as long as 2; hairs of the upper surface of the hind tibia very slightly longer than the middle width of the tibia; lobe with only three inconspicuous spines.

Abdomen: Petiole less than twice the length of the propodeum, 7 : 4, its sculpture fine and without a conspicuous longitudinal element. Tergite (2 + 3) without a trace of a differentiated lateral margin, extremely finely and evenly beaded (shagreened); epipleura of this tergite shining and with close microscopic punctation except at apex and along a line which probably marks the suture between the epipleura of the true second and third tergites. Ovipositor sheaths shorter than the abdomen, about 5 : 6.

Length: 3–3·6 mm. without ovipositor.

PHILIPPINES: Luzon, Mt. Makiling, 1 ♀, the type (*Baker*); Tayabas, Malinao, 1 ♀ (*Baker*).

Type in U.S. National Museum.

Characterised by the form of the postscutellum and the rather strongly convex scutellum.

Spathius calacte sp. n.

Very closely related to *zagreus* sp. n., from which it differs as follows:—

♀. Front and middle tibiae markedly pale (whitish-yellow) on about apical half; both trochanters of the hind leg and all the tarsi whitish-yellow; extreme base of the hind tibiae not pale; hind tibiae and darker portions of the middle and front tibiae more obviously darker than their femora than in *zagreus*.

Head: Frons completely smooth. Vertex in the type virtually smooth; only the merest trace of aciculation behind the ocelli; completely smooth in the second female. Antennae with at least 29 segments (type ♀).

Thorax: Mesonotum more shining, the meshes of the reticulation wider than in *zagreus*. Notaulices posteriorly rather more clearly indicated by a roughening of the surface sculpture, but as in *zagreus* there is no indication of raised lines or rugae. Scutellum less convex; in the type, considerably roughened around sides and posteriorly. Postscutellum with a small medial dentiform process. Areola of the propodeum still more indistinct; costulae completely wanting. Mesopleura more extensively smooth and shining. Lobe of the hind tibia with 5–6 spines; hairs of the upper surface of the hind tibia shorter in proportion to its middle width.

Abdomen: Epipleura of tergite (2 + 3) more shining, the distribution of punctation similar but the punctures finer and sparser. Ovipositor sheaths shorter, as long as the gaster.

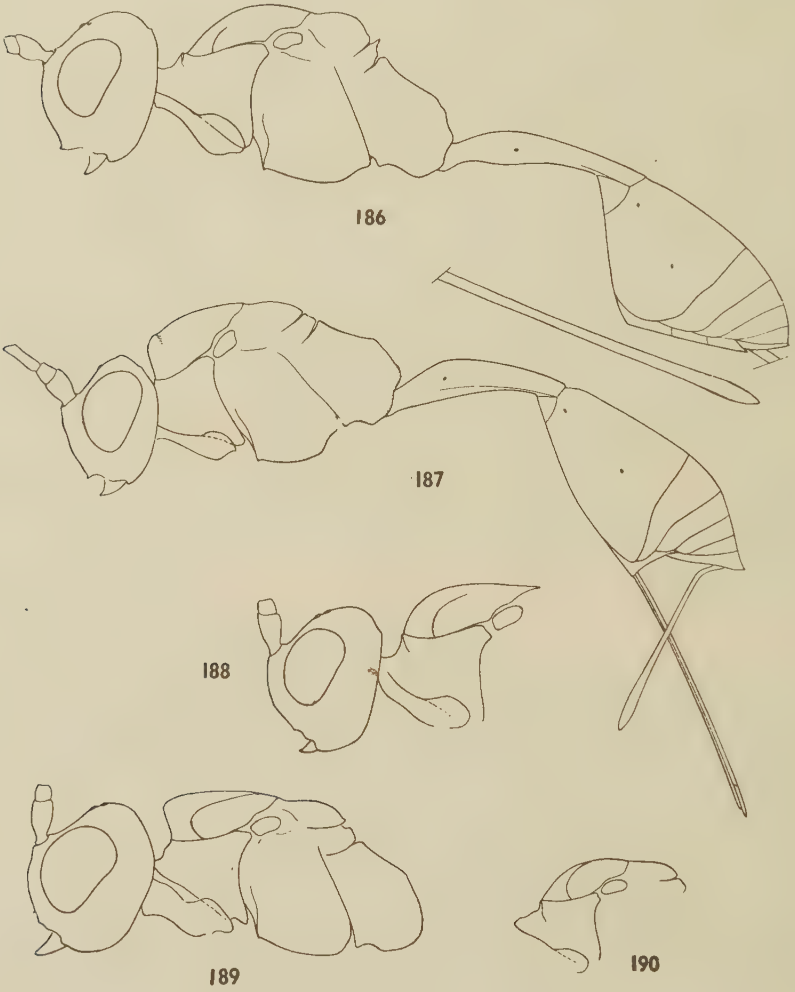
PHILIPPINES: Luzon, Mt. Makiling, 2 ♀♀, one the type (*Baker*).

Type in U.S. National Museum.

This species differs at once from *zagreus* in the form of the postscutellum.

Spathius antisthenes sp. n. (fig. 186).

This species is amply distinct from *zagreus* and *calacte.* It differs from *zagreus* as follows :—



Figs. 186–190.—186. *Spathius antisthenes* sp. n., body, lateral, Type; 187. *S. vindicius* sp. n., body, lateral; 188. *S. gelleus* sp. n., head and part of thorax; 189. *S. siculus* sp. n., head and thorax, lateral; 190. *S. zagreus* sp. n., anterior part of thorax.

♀. Apical segment of the maxillary palpi dark like the other segments. Petiole with a yellowish tint on apical half; 7th tergite yellow in the type but hardly so in the second female. Front and middle coxae pale brown, only slightly paler than the hind coxae; hind tibiae not at all darker than their femora and not pale at base; front and middle tibiae more extensively pale, but showing a distinct darkening at base.

Head : Frons in greater part smooth, polished, there being only the merest trace of fine striation above each antennal insertion. Vertex virtually smooth; in the type there is the merest trace of aciculation at middle between the ocelli and the occipital margin.

Thorax : Pronotal keel completely free. Notaulices having only a trace of longitudinal direction and entirely obliterated on the posterior part of the mesonotum. Mesonotum slightly more shining, the meshes of the reticulation slightly larger. Scutellum with a strong conspicuous longitudinal keel; sculpture consisting of close scaly-reticulation. Postscutellum with a median dentiform process. Costulae of the propodeum absent in both females; basal carina wanting in the type but feebly indicated in the second female; areola virtually absent. Most of the surface above the mesopleural furrow showing faint scaly-reticulation (× 60); against the upper angle of the mesopleura (below the insertion of the hind-wing) is a fairly large smooth area. Hairs of the upper surface of the hind tibia very slightly shorter than the middle width of the tibia.

Abdomen : Gaster evenly dull all over. Tergite (2 + 3) with a microscopically fine sculpture which extends over its entire surface and also in equal intensity over the entire surface of its epipleura; the segment has in consequence a dull appearance and its sculpture is quite indefinite at a magnification of × 60; on about basal quarter there is a tendency for the surface to be slightly rougher and the sculpture here describable as extremely fine rugulosity. Following tergites and their epipleura similarly sculptured. Ovipositor sheaths very slightly shorter than the total length of the abdomen.

Length : 3·7 mm. without ovipositor.

PHILIPPINES : Luzon, Mt. Makiling, 2 ♀♀, one the type (*Baker*).

Type in U.S. National Museum.

This species is readily characterised by the carinate scutellum and the sculpture of the gaster.

Spathius gelleus sp. n.

♀. Differs from *zagreus* as follows :—All the coxae, except the apex of the hind pair which is brown, and both trochanters of the hind leg yellowish; hind tibiae darkened throughout; front and middle tibiae more extensively pale at apex.

Head : Face with a less clear indication of transverse striation, the surface being merely rugose with slight transverse elements. Frons almost everywhere smooth; only towards the sides is there a trace of fine aciculation. Vertex finely striated all over, the striation reaching the eye-margin and extending on to the temples. Antenna with at least 29 segments.

Thorax : Mesonotum falling almost perpendicularly to the pronotum (fig. 188); slightly more shining. Notaulices slightly deeper and more rugose at the shoulders but completely obliterated posteriorly; posteriorly the mesonotum shows a short delicate ridge (the existence of this single ridge is probably not characteristic of the species, and individuals might be expected to turn up in which there would be more raised sculpture or possibly none at all). Postscutellum with an extremely feeble dentiform process, showing in profile as a slight angulation. Mesopleura with fine sculpture all over, mostly scaly-reticulation mixed with weak rugulosity in places. Propodeum with a completely defined though somewhat feeble basal carina, areola and costulae. Apical lobe of the hind tibia with a complete row of spines; hairs of the upper surface of the hind tibia shorter than its middle width.

Abdomen : Tergite (2 + 3) completely and evenly matt at a magnification of × 60, having a microscopically fine indefinite sculpture which extends all over the epipleura of the segment. Following tergites similarly sculptured but more finely. Ovipositor sheaths slightly longer than the gaster.

Length : 3 mm. without ovipositor.

PHILIPPINES : Tayabas, Malinao, 1 ♀, the type (*Baker*).

Type in U.S. National Museum.

This species differs from the others I have placed in the group by the abrupt anterior slope of the mesonotum. Probably also characteristic of the species are :—extensive striation of the vertex and excessively fine sculpture of the gaster. In this last respect the species resembles *antisthenes* sp. n.

Spathius tros sp. n.

♀. Colour somewhat variable; in the type, the head and thorax are unicolorous, more or less pale yellowish-brown; in the paratype (Mt. Makiling), roughly the posterior $\frac{2}{3}$ of the thorax are darkened and the petiole and gaster are similarly darkened. Palpi blackish. Legs in greater part dull brownish-red, the tibiae very slightly darker than their femora; hind tibiae whitish on about basal $\frac{1}{6}$; hind coxae in greater part yellow, slightly, embrowned towards apex; the more basal flagellar segments are ringed with brown at apex.

Head transverse, clearly a little narrower behind the eyes than across them. Face with feeble transverse, broken striation. Frons completely smooth. Vertex with feeble aciculation on about posterior $\frac{2}{3}$; this aciculation is separated from the eye-margin by a broad smooth space and is absent on temples. Antenna broken, but to judge from the balance of light and dark flagellar segments, it is probably about 27-segmented; flagellar segment 1 very slightly longer than scape plus pedicel 11 : 10.

Thorax : Pronotal keel very feeble, medially widely fused with the posterior margin of the pronotum; lateral area well defined. Mesonotum at first sight appearing glabrous, having only a very few fine hairs which are rather short; lobes in far greater part with a shining scaly-reticulation; notaulices distinct; no trace of posterior ridges; in the type and paratype a single feeble irregular ridge is present which lies within a plexus of feeble rugulosities. Scutellum nearly flat, scaly-reticulate. Postscutellum in profile with hardly a trace of a dentiform process. Propodeum with only feeble indistinct areation; basal carina a little longer than its forks; dorsal areas covered with a network of feeble reticulation which tends to merge into scaly-reticulation anteriorly. Mesopleura almost smooth above the furrow; postero-ventrally with a patch of dull, finely rugulose sculpture. Hind coxa simple; hairs of the upper surface of the hind tibia, sparse, hardly $\frac{3}{4}$ its middle width; apical lobe with 2–3 hardly visible spines; hind tarsus 1 twice 2; 3 as long as 5. Nervus parallelus exactly interstitial.

Abdomen : Petiole $1\frac{3}{4}$ times as long as the propodeum, fairly slender, finely rugose-striolate. Tergite $(2 + 3)$ dull, excessively finely punctate-reticulate, giving a beaded effect; following tergites becoming progressively more finely sculptured and hence more shining towards apex; epipleura of tergite $(2 + 3)$ extremely finely and fairly closely punctate. Ovipositor sheaths about as long as the gaster.

Length : 3·5 mm. without ovipositor

PHILIPPINES : Los Baños, 1 ♀, the type (*Baker*); Luzon, Mt. Makiling, 1 ♀ (*Baker*). MALAYA : Singapore, 1 ♀ (*Baker*).

Type in U.S. National Museum.

This is a somewhat aberrant member of the *dissors*-group and is altogether more generalised in appearance than its allies. The fore-wings are hardly dappled at all and this, in combination with the fully developed notaulices, perhaps places the species in a somewhat isolated position; the sculpture of the mesonotum is important for its recognition.

Spathius siculus sp. n.

♀. Brown, with a yellowish tinge, more especially noticeable on the thorax. Pale segments of the flagellum not very markedly ringed with black apically. Hind coxae brown on about apical half, otherwise yellow; hind tibiae not at all or only very faintly paler at extreme base.

Head not narrower behind the eyes than across them. Face with broken transverse striation, more or less obliterated on the medial elevation. Frons and vertex closely smoothly striate. Antenna with 30 segments (1 ♀). Eyes large, their longer axis 3 times as long as the malar space. Ocelli arranged in a triangle with base clearly longer than sides.

Thorax (fig. 189): Pronotal keel undeveloped; lateral area fairly sharply delimited. Middle lobe of the mesonotum sharply angularly truncate in front, the truncature feebly concave, its base lying distinctly posterior to its apex; the " shoulders " are very prominent, submargined along their anterior side; notaulices well defined throughout, costate; posterior carinae well defined, even; sculpture of the lobes consisting of scaly-reticulation which tends to be less close on the posterior part of the middle lobe. Scutellum rather strongly and evenly convex, the anterior depression with 6 strong ridges. Postscutellum in profile almost flat. Propodeum completely areated but the dividing carinae weak; basal carina as long as its forks; areola fused with the area petiolaris; dorsal areas dull, predominantly scaly-reticulate. Disc of the mesopleura smooth, shining. Hind coxa rather sharply angled at base and with the merest indication of a dentiform projection; hairs of the hind tibia very sparse, those along its upper surface nearly erect, as long as the middle width of the tibia; hind tarsus 1 a trifle more than twice 2, 7 : 3; 3 is $\frac{2}{3}$ of 5. Wings much like those of *zagreus* (cf. fig. 185), except that basal third of median and submedian cell are hyaline and without hairs.

Abdomen: Petiole about $1\frac{1}{2}$ times as long as the propodeum, with fine broken longitudinal striation. Tergite (2 + 3) finely scaly-reticulate, the reticulation being slightly more wide-meshed on a rather ill-defined basal area; the epipleura of this segment are covered with wide-meshed scaly-reticulation; following tergites with a fine surface sculpture. Ovipositor sheaths about as long as gaster plus petiole.

Length: about 3 mm. without ovipositor.

INDIA: Madras, Nilambur, 6 ♀♀, one the type, 21.i.1924 (*B. M. Bhatia*). Punjab, Rawalpindi, 1 ♀, bred 9.x.1924 from bamboo pole.

Type in British Museum (Natural History).

This is a most distinctive species on account of the form of the mesonotum and could not be confused with any other species dealt with in this monograph. It must be considered, I think, a somewhat aberrant member of the group of *dissors*, but beyond doubt has a nearer affinity to this group than to any other chiefly because the gaster shows the peculiar sculpture characteristic of *dissors* and its allies. An approach to the conformation of the mesonotum is a feature of the closely related *rusticulus*-group, among which *hecate* sp. n. and *araeceri* sp. n. have the mesonotum very sharply truncate in front, but the truncature is more generalised in appearance and its anterior margin is not submargined.

Spathius vindicius sp. n. (fig. 187).

♀. Thorax brown, suffused faintly in places with blackish; this is most noticeable on the posterior part of the mesonotum and within the scutellar region; the propodeum is quite markedly blackish above while its posterior declivous face remains evenly reddish-brown; head, posterior half of the petiole, virtually entire surface of tergite (2 + 3) and apex of gaster markedly yellowish in tint. Fore-wing much dappled (fig. 182). Palpi, except the apical segment of the maxillary palpi, blackened. Antennae yellowish, the apical 4 segments of the flagellum faintly ringed with brown at apex. Front and middle coxae with a dark brown patch on their outer side, elsewhere whitish-yellow; hind coxae in far greater part whitish-yellow but ringed with brown at apex; front and middle trochanters brown; basal trochanter of the hind leg whitish-yellow; hind tibiae dark brown throughout, contrasting with their paler femora; front and middle tibiae mostly yellowish with a slight darkening at base.

Head strongly transverse, unusually short behind the eyes. Face with weak, broken, rather widely spaced striation. Frons with some indication of feeble, transverse aciculation. On either side of the posterior ocelli there is a smooth area, but beyond this area, against the eye-margin, there is indication of feeble scaly-reticulation. Vertex with a somewhat sharply defined, posterior declivous surface. Segments of the palpi considerably shorter than in the other species of the *dissors*-group. Antenna somewhat thick, 27-segmented; flagellum 1 as long as 2 and slightly shorter than scape plus pedicel, 9 : 10. Base of the ocellar triangle clearly a little longer than its sides.

Thorax: Pronotal keel very feeble, fused with the posterior margin of the pronotum. Mesonotum strongly gibbose in front, and with unusually prominent " shoulders "; falling vertically to the pronotum; its sculpture consists of delicate scaly-reticulation on a shining surface; virtually no raised sculpture posteriorly; notaulices absent on the disc, having only lateral direction and forming on each side of the mesonotum deep shoulder clefts. Scutellum weakly convex, scaly-reticulate. Postscutellum without a dentiform process when seen from the side. Propodeum completely and regularly areated; basal carina about $1\frac{1}{2}$ times as long as its forks; areola confluent with the area petiolaris; dorsal areas dull, over their greater surface with close scaly-reticulation. Mesopleural furrow crossed by fine striation; a large smooth tract extends from the furrow upwards towards the insertion of the hind-wing. Middle tarsus short, stout, segment 1 being about $2\frac{1}{2}$ times as long as wide and 3 hardly $\frac{2}{3}$ as long as 5; hairs of the upper surface of the hind tibia as long as its middle width; apical lobe with two inconspicuous spines. Medius of the fore-wing taking a deep downward curve just beyond middle; nervus parallelus interstitial.

Abdomen: Petiole $1\frac{1}{2}$ times as long as the propodeum, rather strongly narrowed towards apex. Tergite (2 + 3) dull, its sculpture microscopically fine, quite indeterminate; along the lateral margin the surface is narrowly (but widening towards apex) smooth, shining; epipleura of tergite (2 + 3) ventral to a line joining the spiracles, dull, the sculpture appearing even more opaque than that of the dorsal surface of the tergite; following tergites in greater part, smooth, shining. Ovipositor sheaths slightly shorter than the gaster.

Length: 3 mm. without ovipositor.

PHILIPPINES: Luzon, Mt. Makiling, 1 ♀, the type (*Baker*).

Type in U.S. National Museum.

This is an extremely distinctive species, chiefly on account of the very transverse head and the shape of the mesonotum. The coloration of the antennae, the blackened hind tibiae, the dappling and venation of the fore-wing and the position of the medius, the absence of notaulices and of raised sculpture on the posterior part of the mesonotum, all suggest a relationship with the group of *dissors*, and I think *vindicius* is best placed here, at least provisionally.

Spathius gylippus sp. n.

In the sculpture of the mesonotum this species shows a marked departure from the type of mesonotum possessed by the other members of the group.

♀. Brown, the propodeum, petiole (except apex which is pale) and gaster darker. Antennae typical of the group, yellow, becoming uniformly darkened towards apex; the more basal flagellar segments are faintly ringed with brownish at extreme apex. Front coxae and trochanters brownish; middle coxae, middle and hind trochanters yellow; hind coxae yellowish beneath at base; front and middle tibiae at apex and hind tibiae at base, yellowish; tarsi except the basal segment of the hind pair (which is usually darkened), yellowish. Fore-wing hardly dappled in the way that *zagreus* is; much darkened, pale at apex and with a complete hyaline fascia cutting base of stigma; towards base of wing there is a large pale area but it is not at all clearly delimited (fig. 183).

Head not narrower behind the eyes than across them. Face with transverse broken striation which is more or less interrupted along the middle. Frons with indication of transverse aciculation but completely smooth in the two females from Davao. Vertex with a variable amount of fine striation behind the ocelli; even in individuals which show the strongest development of this striation, it fades out at a considerable distance from the eye-margin. Antenna with at least 36 segments in largest individuals; probably about 40 segments represents the maximum.

Thorax: Pronotal keel widely fused medially with the posterior margin of the pronotum; the posterior margin of the pronotum is itself darkened, well defined and slightly raised. Mesonotum sloping fairly gradually to the pronotum, but less gradually than in typical members of the group; scaly-reticulate; hairs very sparse, tending to be restricted to the course of the notaulices. Notaulices well defined though shallow on posterior half where they are margined each by a strong, fairly even keel; these keels are sometimes broken, especially in small individuals and the space between them has a few feeble rugae. Scutellum feebly convex, scaly-reticulate. Postscutellum in profile hardly dentiform, showing merely as a sharp angulation. Propodeum: basal carina, areola and costulae usually distinct but feeble; dorsal areas with fine rugose-reticulation which tends to fade out into scaly-reticulation at base. Mesopleura smooth and shining over most of its surface; within the subalar impression longitudinally striate; furrow transversely costate. Fore-wing typical of the group (fig. 183). Legs: hind coxa with only a trace of tooth beneath; hind tibia with a complete row of spines at apex; hairs of the upper surface of the hind tibia very slightly longer than its middle width; middle tarsus 1 about 4 times as long as wide; hind tarsus 1 twice 2.

Abdomen: Petiole $1\frac{1}{3}$ times as long as the propodeum. Tergite (2 + 3) with an extremely fine-beaded sculpture which laterally reaches the apex but medially leaves a narrow smooth apical margin. Following tergites similarly but more finely sculptured. Epipleura of tergite (2 + 3) shining and with an extremely fine close punctation (punctures separated by 2–3 diameters). Ovipositor sheaths about $\frac{3}{4}$ the length of the whole abdomen.

Length: 3–4 mm. without ovipositor.

PHILIPPINES: Mindanao, Zamboanga, 7 ♀♀, one the type (*Baker*). Davao, 2 ♀♀; Butuan, 1 ♀. I. of Basilan, 1 ♀ (*Baker*).

Type in U.S. National Museum.

The female from Butuan has almost the apical half of the hind tibiae whitish.

This species is characterised within the narrow limits of the group by the presence of raised sculpture on the posterior part of the mesonotum, in combination with the gradual anterior slope of this sclerite.

Group of *rusticulus* Wilkinson.

The separation of this group from that of *dissors* Wilkinson is somewhat artificial and is based essentially on a single absolute difference which is found in the sculpture of the face. This consists of an area (entirely or almost entirely taking up the whole surface of the face) of excessively fine absolutely even transverse aciculation, resembling the surface of a gramophone record. Otherwise the species of the two groups are very similar.

AFRICA; MALAYA; BORNEO; PHILIPPINES. Seven species.

Key to the species of the *rusticulus* group.—Females.

1. Eyes small, their longer axis hardly $1\frac{1}{2}$ times as long as the malar space. (Mesonotum posteriorly with at least 2 or 3 delicate wrinkles; ovipositor sheaths a little longer than the gaster) . *rusticulus* Wilkinson (p. 352).
–. Eyes larger, at least $1\frac{3}{4}$ times as long as the malar space and then the ovipositor sheaths are clearly shorter than the gaster . . . . 2.
2. Mesonotum in profile falling perpendicularly or almost so to the pronotum; middle lobe of the mesonotum truncate or subtruncate in front, the "shoulders" very prominent (Spp. with no hairs—in *hecate* sp. n., the merest trace—in the narrowed proximal part of the median cell) . . . 3.
–. Mesonotum in profile sloping gradually to the pronotum; middle lobe evenly convex, the "shoulders" not in the least prominent (hairs present in this part of the median cell) . . . . 6.
3. Notaulices more or less absent on the disc; mesonotum posteriorly with at most a single fine ridge. 4.
–. Notaulices deep and distinct throughout; mesonotum posteriorly with a considerable amount of raised sculpture . . . . *hecate* sp. n. (p. 356).
4. Gaster somewhat flattened beneath, the epipleura of the tergites strongly shining and more or less smooth; no hyaline patch within the 1st discoidal cell. (Ovipositor sheaths clearly shorter than gaster) *rusticuloides* sp. n. (p. 354).
–. Gaster not at all flattened beneath, the epipleura of the tergites dull, finely sculptured all over; a subhyaline patch within the 1st discoidal cell . . . . 5.
5. Ovipositor sheaths considerably longer than the gaster *prusias* sp. n. (p. 354).
–. Ovipositor sheaths a little shorter than the gaster . *araeceri* sp. n. (p. 355).
6. Hind coxae strikingly bicolorous, yellow at base, brown at apex; propodeum with no trace of an areola; postscutellum in profile without a trace of a projection . . . . *rhianus* sp. n. (p. 356).
Hind coxae unicolorous, brownish-yellow; propodeum with an ill-defined areola; postscutellum in profile with a distinct, though small, dentiform projection . . . . *priscus* sp. n. (p. 358).

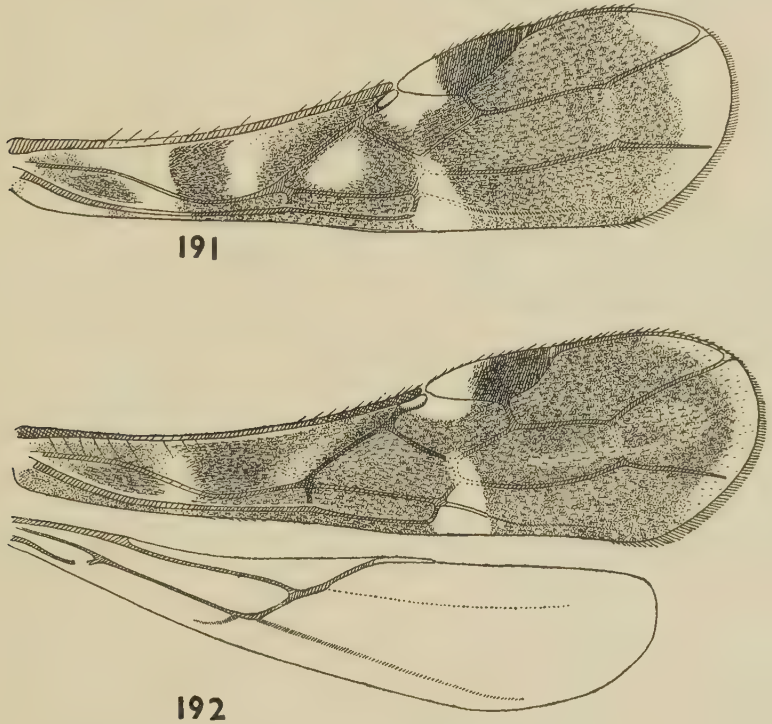
Spathius rusticulus Wilkinson.

Spathius rusticulus Wilkinson, 1931, *Trans. ent. Soc. Lond.* **79** : 517, ♂♀.

♀. More or less deep chocolate-brown with the head paler, yellowish-brown in tint. Antennae dull yellowish with the apical 6–9 segments more or less entirely blackened; the remaining flagellar segments are narrowly tipped with black at apex. Palpi blackish throughout. Middle and hind coxae brownish, becoming paler to yellowish on about basal half; femora and tibiae dark brown throughout, the latter sometimes paler at extreme base; tarsi dull yellowish, the basal segment of the hind pair a little infuscated. Fore-wings very strongly brownish; stigma pale on about basal third; a hyaline fascia crosses the submedian cell just proximal to its narrowest point (fig. 192); hind-wing very faintly clouded.

Head behind the eyes as wide as across them or even a little wider. Face evenly convex from eye-margin to eye-margin, having a satiny sheen. Frons and vertex with very fine close smooth striation which extends over the temples and postgenae to as far as the base of the mandibles. Ocelli in a triangle with base clearly longer than sides. Eyes small, decidedly a little flattened, their longer axis slightly less than $1\frac{1}{2}$ times the length of the malar space 18 : 13. Antenna with 27–28 segments (2 ♀♀); flagellum 1 only a trifle longer than scape plus pedicel, 15 : 13. Vertex not steeply, that is, not angularly declivous behind as in most species.

Thorax : Pronotal keel very poorly developed, widely fused with the posterior margin of the pronotum ; lateral area poorly defined. Mesonotum falling almost perpendicularly to the pronotum, dull, finely scaly-reticulate ; posteriorly there is a small amount of raised sculpture consisting chiefly of a few feeble longitudinal wrinkles ; hairs extremely sparse ; notaulices very weakly defined and virtually absent on the horizontal surface of the mesonotum. Scutellum quite strongly convex, dull, closely scaly-reticulate. Postscutellum in profile with only the merest trace of a projection. Propodeum : no trace of a basal carina, the entire dorsal surface dull, scaly-reticulate ; no trace of an areola, but an area petiolaris, open above, is present ; its lateral bounding carina, in one female, are continuous with weak costulae. Mesopleural furrow extending just beyond middle, very feebly costate ; disc dull, evenly scaly-reticulate ; this sculpture extends all over the subalar impression. Legs : hind coxa angularly rounded beneath ; hairs of the upper surface of the hind tibia short, hardly half as long as its middle width ; lobe with a complete row of 6 spines ; hind tarsus 1 a trifle more than twice 2, 23 : 10 ; 3 a trifle shorter than 5. Wings (fig. 192) ; no hairs in the narrowed proximal part of the median cell.



FIGS. 191–192.—Wings of *Spathius* :—191. *Spathius araeceri* sp. n. ; 192. *S. rusticulus* Wilkinson.

Abdomen : Petiole broad, about twice as long as the propodeum, dull, rather finely reticulate-rugose, the longitudinal element not very pronounced. Gaster dull, its dorsal surface extremely finely rugulose everywhere ; similar sculpture occurs all over the epipleura of the tergites but it is less close and tends to resemble scaly-reticulation. Ovipositor sheaths clearly a little longer than the gaster.

♂. Like the female except that the antenna has 24 segments in the unique example and the thorax is a little paler.

Length: ♂♀, 4–4·5 mm. without ovipositor of female.

AFRICA: Pondoland, Port St. John, 3 ♀♀, 1 ♂ (*R. E. Turner*); Zululand, Eshowe, 1 ♀ (*R. E. Turner*).

Type in British Museum (Natural History).

I also refer to this species a single female from Port St. John and labelled "cotype" by Wilkinson, which is altogether paler in colour, has the middle and hind coxae more obviously bicoloured (there is much more yellow than brown in them) and all the tarsi entirely pale yellow.

The small eyes are the most salient feature of this species.

Spathius rusticuloides sp. n.

Apart from a striking difference in size, this species closely resembles *rusticulus* and even more closely *prusias* sp. n., with which species I shall also eventually compare it. A comparison with *rusticulus* is as follows:—

♀. Paler in colour, but not different in colour from the rather small female of *rusticulus* from Eshowe; thorax reddish-brown with the propodeum darkened above; hind coxae more or less evenly brownish, hence lacking the bicolorous appearance which is usually characteristic of *rusticulus*; all the tarsi yellow with the apical segment a little darkened; petiole pale on apical half, dark on basal half; this differentiation is merely indicated in *rusticulus*.

Antenna with 20–24 segments (5 ♀♀), the pale segments of the flagellum more decidedly yellow, their articulations more sharply blackened; apical 4–7 segments blackened. Vertex, seen from the side, almost angularly declivous behind (fig. 197). Eyes larger, not at all flattened, their longer axis almost twice the length of the malar space, 12 : 17.

Mesonotum without a trace of raised rugosity posteriorly. Postscutellum in profile without a trace of a projection. Hairs of the hind tibia a little longer and sparser.

Petiole a little more slender; gaster somewhat flattened beneath, the epipleura of the tergites strongly shining and almost smooth. Ovipositor shorter, the sheaths distinctly a little shorter than the gaster.

Length: 2–2·5 mm. without ovipositor.

S. AFRICA: Pondoland, Port St. John, 10–13.vii.1923, 1 ♀, the type; 5–30.iv.1923, 1 ♀; ix.1923, 1 ♀; xii.1923, 1 ♀; 1–15.iv.1924, 1 ♀ (*R. E. Turner*). Zululand, Eshowe, 23–30.iv.1926, 1 ♀ (*R. E. Turner*).

Type in British Museum (Natural History).

Of all the differences mentioned above, the most easily appreciated are the larger eyes and shorter ovipositor.

This species is extremely closely allied to *prusias* sp. n. from Malaya, differing from it in the evenly convex face (its aciculation preserving its characteristic appearance right up to the eye-margin), virtually unemphasised mesonotal "shoulders", no hyaline patch within the 1st discoidal cell, shorter, less erect hairs on the upper surface of the hind tibia, in having the 2nd abscissa of the radius shorter in proportion to the 1st intercubitus, the ventral surface of the gaster shining and the ovipositor shorter.

Spathius prusias sp. n.

♀. More or less evenly brown. Antennae up to about the 21st segment yellowish, the flagellar segments rather strikingly ringed with black at apex. Palpi blackish, but the apical segment of the maxillary palpi pale. Hind coxae brown; middle and front pairs paler; all the femora brown; middle and hind tibiae distinctly darker than their femora, slightly pale only at extreme apex. Fore-wing dappled; a well-defined hyaline spot is present in the 1st discoidal cell.

Head rather markedly transverse, clearly narrower behind the eyes than across them. Greater part of the face, *i.e.* the area occupied by the specialised aciculation, slightly raised above the surface along the edge of the eye and cheek (this is not so in the female from Mt. Makiling); this bordering surface merely finely striate. Frons and vertex finely striate, the striation fading out towards the temples and against the eye-margin. Base of the ocellar triangle clearly longer than its sides. Vertex with a short, steep, posterior declivous surface. Head behind the eyes smooth except for some feeble obsolescent striation along the occipital margin. Antenna with 25 segments in the type (broken); since the last two segments are darkened, it is probable that the antenna would have about 30 segments. Eyes large, their longer axis 2½ times as long as the malar space.

Thorax: Pronotal keel barely indicated, medially apparently fused with the posterior margin of the pronotum. Mesonotum falling almost perpendicularly to the pronotum; middle lobe subtruncate in front, its "shoulders" very prominent; hence a deep notch between the middle and lateral lobe at the inception of the notaulices; notaulices completely absent on the dorsal surface of the mesonotum; the sculpture of the mesonotum consists of shining scaly-reticulation with no trace of raised sculpture posteriorly. Scutellum rather strongly convex. Postscutellum in lateral aspect without a trace of a dentiform process; in the type and the female from Mt. Makiling but less so in the second female from Singapore, the postscutellum is medially widely smooth, polished. Areation of the propodeum obsolescent; the areola is more or less indicated in the females from Singapore but is virtually absent in the specimen from Mt. Makiling; the same applies to the dorsal areas, the surface of which is covered with close even scaly-reticulation. Mesopleura all over with rather wide-meshed scaly-reticulation. Legs: hind coxa without a projection beneath; hairs of the upper surface of the hind tibia more or less erect, not longer than its middle width; apical lobe with a complete row of spines; hind tarsus 1 more than twice 2, 17 : 7; 3 is ⅔ of 5. Wings as in *araeceri* sp. n. (cf. fig. 191).

Abdomen: Petiole about 1⅔ as long as the propodeum; gaster not in the least flattened beneath; tergite (2 + 3) dull, with an excessively fine sculpture which covers its epipleura also; no trace of a lateral differentiated margin. Ovipositor sheaths a little shorter than the whole abdomen.

Length: about 3 mm. without ovipositor.

MALAYA: Singapore, 2 ♀♀, one the type (*Baker*). PHILIPPINES: Luzon, Mt. Makiling, 1 ♀ (*Baker*).

Type in U.S. National Museum.

Very important for the recognition of this species is the length of the ovipositor.

Spathius araeceri sp. n.

This species closely resembles *prusias*, having in common with it the mesonotum sharply truncate in front. It is also very much like *rusticuloides* sp. n., and differs from both species only in a few small details. A comparison with *prusias* follows :—

♀. On the whole rather darker in colour. Antenna a little shorter, with 24–26 segments (8 ♀♀).

Mesonotum a little more sharply truncate in front, the "shoulders" a little more prominent (fig. 198); posteriorly a single fine longitudinal carina. Ovipositor sheaths distinctly a little shorter than the gaster.

♂. Like the female except for the sexual differences. In the two examples in the series, the antenna is 23- and 24-segmented.

JAVA: Salatiga, 10 ♀♀, 2 ♂♂, one ♀ the type, bred from *Araecerus fasciculatus* Degeer out of pods of *Tephrosia candida* (*P. v. d. Goot Coll.*). MALAYA: Serdang, 1 ♀ (Ref. No. 5976), bred 20.iii.1929 (*H. T. Pagden*).

Type in British Museum (Natural History).

In having a short ovipositor, this species closely resembles the African *rusticuloides* sp. n., but differs in having the fore-wings more dappled in appearance—this is due chiefly to the hyaline patch in the 1st discoidal cell—the eyes larger and the face not evenly convex from eye-margin to eye-margin, the large broadly oval specialised area being clearly raised above the surface along the eye-margin; in addition, the 2nd abscissa of the radius is longer in proportion to the 1st intercubitus.

Spathius hecate sp. n. (fig. 196).

♀. May be compared with *prusias* as follows :—

Pale brownish-yellow to the naked eye; the dorsal surface of the gaster shows faint yellowish bands and the ventral surface is decidedly yellowish all over. Hind coxae pale yellow almost throughout, only the apical margin being faintly tinged with brown; hind tibiae, as in *prusias*, darker than their femora, but pale at extreme base; front and middle tibiae yellow throughout; front and middle femora paler than the hind pair, almost yellow, but darkened along their supper surface. Fore-wing dappled as in *araeceri*, but the contrasts less sharp (cf. fig. 191).

Face evenly convex from eye-margin to eye-margin. Eyes a little larger. Mesonotum more sharply truncate in front, wider across the " shoulders " which are more prominent; notaulices complete, converging on to a sunken area, rugose-reticulate and lying considerably below the level of the middle lobe; posterior carinae merely indicated posteriorly; sculpture of the lobes consisting of somewhat roughened glistening scaly-reticulation. Scutellum quite strongly convex. Postscutellum in profile with the merest indication of a dentiform projection. Areola faintly indicated. Hairs of the upper surface of the hind tibia almost adpressed, set at an angle of about 15 degrees.

Tergite (2 + 3) finely longitudinally rugose-aciculate; the aciculation is distinct on an ill-defined basal area, but on apical part of the segment it is excessively fine and not readily resolvable. Ovipositor sheaths about as long as the gaster.

JAVA: Buitenzorg, 250 m., 5.vii.1924, 1 ♀ (*L. G. E. Kalshoven*).

Type in British Museum (Natural History).

An aberrant member of the group, differing from all its congeners in having sharply defined notaulices and a rugose area on the posterior part of the mesonotum.

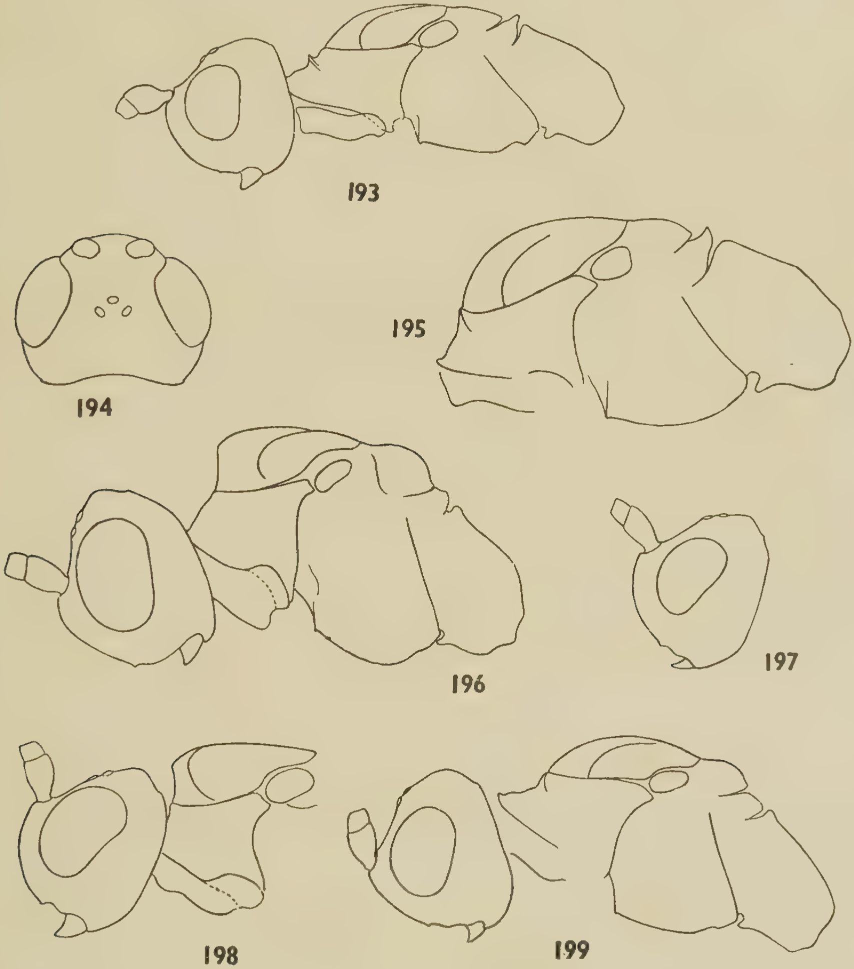
Spathius rhianus sp. n. (fig. 199).

♀. Differs from *prusias* as follows :—

Antennae brownish-yellow; the first 4–5 segments of the flagellum yellower than those following and virtually not ringed with brown at apex. Front coxae brown; hind coxae yellow over about basal half, brown elsewhere.

Head very slightly less transverse. Striation of the vertex finer, virtually absent on about anterior half. Posterior declivous surface of the vertex less steep, smooth. Antenna with at least 27 segments.

Pronotal keel defined, medially narrowly fused with the posterior margin of the pronotum. Mesonotum sloping gradually to the pronotum (fig. 199), its sculpture slightly less fine and less even, the general effect more glistening; notaulices feebly indicated to about middle of the disc; posteriorly the mesonotum shows the usual two carinae, which are sharp, unbroken and form a narrow V-shaped mark; hardly a trace of other raised sculpture posteriorly. Scutellum only very feebly convex. Postscutellum not polished medially. Propodeum without a trace of an areola; basal carina barely indicated; entire dorsal surface of the propodeum extremely finely reticulated, though anteriorly the sculpture appears to be more or less scaly-reticulate. Mesopleura over its greater medial surface very shining, almost smooth, with feeble indication of aciculation spreading concentrically from the subalar impression.



FIGS. 193–199.—193. *Spathius fragilis* sp. n., head and thorax, lateral; 194. *S. urios* sp. n., head, dorsal; 195. *S. ocyroe* sp. n., thorax, lateral; 196. *S. hecate* sp. n., head and thorax, lateral; 197. *S. rusticuloides* sp. n., thorax, lateral; 198. *S. araeceri* sp. n., head and thorax, lateral; 199. *S. rhianus* sp. n., head and thorax, lateral.

Abdomen: Tergite (2 + 3) with a roughly semicircular basal area separated from the rest of the tergite by being slightly differently sculptured; outside the area, the sculpture is finely aciculo-rugulose with a slight concentric tendency; within the area, the surface is finely vaguely rugulose-reticulate. Epipleura of tergite (2 + 3) shining, microscopically punctate. Ovipositor sheaths slightly shorter than the gaster.

Length: 3·5 mm. without ovipositor.

Philippines : Luzon, Mt. Makiling, 1 ♀ (*Baker*).

Type in U.S. National Museum.

This species is characterised by the anterior slope of the mesonotum, posterior V-shaped mark of the mesonotum and by the bicolorous hind coxae.

Spathius priscus sp. n.

♀. Differs from *prusias* as follows :—

Pale brownish-yellow. The more apical flagellar segments are slightly darkened at extreme base as well as being darkened at apex; only 26 antennal segments are present but the apical one is still predominantly yellowish. Front and middle coxae yellowish; hind pair brownish-yellow; all the femora pale brownish-yellow; hind tibiae only slightly darker than their femora; middle tibiae virtually yellowish throughout. Darker parts of the forewing less darker than in *prusias*, hence the dappled effect less marked.

Head : Frons with only a trace of aciculation. Vertex with very feeble aciculation; the surface between the ocelli and the eye widely smooth, shining. Base of the ocellar triangle slightly longer. Antenna with at least 27 segments.

Thorax : Pronotal keel clearly defined, medially fused with the posterior margin of the pronotum. Mesonotum sloping gradually to the pronotum; posteriorly almost without raised sculpture, there being present only a short, feeble ridge which has a weak branch on its left side; notaulices barely indicated. Scutellum slightly less convex. Postscutellum in profile showing a slight dentiform projection. Propodeum : basal carina feebly indicated, much longer than its forks; areola defined, except where it joins the basal carina.

Ovipositor sheaths a little shorter than the abdomen, about 8 : 9.

Length : about 3·2 mm. without ovipositor.

Borneo : Sandakan, 1 ♀ (*Baker*).

Type in U.S. National Museum.

Resembles also *rhianus* in the gradual anterior slope of the mesonotum but differs in the sculpture of the mesopleura, of tergite (2 + 3) and its epipleura and in having unicolorous hind coxae, *inter alia*.

Group of **ocyroe** sp. n.

Spathius ocyroe sp. n.

♀. Head pale reddish-brown; thorax and abdomen dark brown, appearing almost black to the naked eye but the pronotum and the anterior declivous part of the mesonotum showing a reddish suffusion. Palpi slightly darkened. Basal two-thirds of the flagellum yellowish, the segments thence becoming uniformly brown; the yellowish segments of the flagellum are faintly ringed with brown at apex. Front and middle coxae honey-yellow; hind coxae dark brown; all the femora brown; all the tibiae brown except at extreme apex; extreme basal narrowed part of the hind tibiae slightly pale; tarsi, except the apical segment which is darkened, yellowish; segment 1 of the hind tarsus with a reddish tinge.

Head rather strongly transverse, hardly narrower behind the eyes than across them. Medial part of the face slightly raised above the surrounding surface to form an oblong blister-like area which is covered with transverse, absolutely even, excessively fine aciculation (like the surface of a gramophone record); the width of this area is slightly more than half the total width of the face between the eyes; surface of the face along the eye-margin towards the cheeks with extremely fine but unspecialised, slightly wrinkly striation. Lateral clypeal grooves clearly marked. Frons and vertex finely, smoothly, transversely striate, the striation reaching the temple and eye-margin. Base of the ocellar triangle markedly longer than its sides. Antenna with 28 segments. Head behind the eyes with faint traces of sculpture.

Thorax: Pronotal keel well defined, sharp, medially widely fused with the posterior margin of the pronotum; lateral area well defined. Mesonotum sloping fairly steeply to the pronotum but not perpendicularly (fig. 195); covered with somewhat rough, glistening scaly-reticulation; posterior carinae well defined, matt; hairs long, very sparse. Scutellum moderately convex, dull, scaly-reticulate but becoming rugose on about posterior third. Postscutellum with a strong, medial dentiform process. Propodeum with fairly well-defined basal carina, areola and costulae; basal carina slightly longer than its forks; dorsal areas with raised rugulosities over most of their surface, only at base is there a trace of scaly-reticulation. Mesopleura covered everywhere with strong raised linear and reticulate rugosities. Hind coxa rounded beneath at base; hairs of the upper surface of the hind tibia slightly shorter than its middle width; apical lobe with a complete row of spines; hind tarsus 1 twice as long as 2; 3 very slightly shorter than 5, 7 : 8. Nervus parallelus not interstitial; appendage of the hind-wing widely antefurcal.

Abdomen: Petiole about 1⅔ as long as the propodeum, showing broken longitudinal ridges on basal half; horizontal surface of the apical half (except for apical fifth, which is finely, closely striate) having a contrasting sculpture of extremely fine reticulation. Tergite (2 + 3) dull, extremely finely rugose and with a pronounced element of fine aciculation in the sculpture; the aciculation converges towards the mid-apical point; epipleura of tergite (2 + 3) dull, microscopically punctate; following tergites dull, like tergite (2 + 3) but with the sculpture still finer. Ovipositor sheaths about as long as the gaster.

Length: about 4 mm. without ovipositor.

PHILIPPINES: Port Banga, xii.1914, 1 ♀, the type (*Böttcher*).

Type in British Museum (Natural History).

A species which seems to have a fairly close relationship with the group of *rusticulus*, more especially with those species in which the mesonotum has a gradual anterior slope such as *rhianus* (cf. fig. 199); the thorax, however, is more generalised in appearance than is that of *rhianus* and *priscus*, lacking the somewhat characteristic narrowing towards the posterior end such as is seen in a lateral view of the thorax of those two species. *S. ocyroe* differs from all the members of the *rusticulus*-group on account of the sculpture of the mesopleura; specifically it is probably characterised by its pale head, sculpture of mesonotum and of mesopleura in combination with the sculpture of tergite (2 + 3).

Group of **urios** sp. n.

The separation of this group from that of *rusticulus* is perhaps rather artificial. The two species are entirely pale yellowish (more or less brownish-yellow). They do not exhibit the characteristic appearance of the thorax of members of the *rusticulus*-group in a lateral view; mesonotum sloping very gradually to the pronotum; notaulices and posterior carinae present. Fore-wings without an obvious dappled appearance. Hind tibiae pale yellowish at base.

MALAYA; PHILIPPINES. Two species.

The two species may be separated as follows :—

(A). Pronotal keel free; palpi whitish-yellow . . . . . *fragilis* sp. n.
(B). Pronotal keel widely fused with the posterior margin of the pronotum; palpi in greater part blackish. . . . . *urios* sp. n.

Spathius urios sp. n.

♀. Pale brownish-yellow. Palpi blackish, except the two apical segments of the maxillary palpi. Flagellum yellowish, the articulations marked only by a very faintly darkened ring. Front and middle coxae honey-yellow; hind coxae pale brownish-yellow, slightly tinted with deeper brown towards the apex; all the femora pale brownish-yellow like the hind coxa; hind tibiae honey-yellow at base, pale brownish-yellow at apex and with a faint brownish cloud on each side at middle. Fore-wing not conspicuously dappled, but pale around the apical margin and having the usual pale medial fascia; basal third of the stigma yellow; the base of the wing is hyaline to about $\frac{2}{3}$ the length of the medius, thence dark to stigma.

Head rather transverse, slightly narrower behind the eyes than across them (fig. 194). Greater part of the face slightly raised above the level of the surface along the eye-margin and cheek; the feeble elevation thus formed is covered with transverse, absolutely even, extremely fine aciculation, like the surface of a gramophone record and having a satiny sheen; along the eye-margin and towards the cheeks this sculpture coarsens into fine striation. Frons and vertex with very fine transverse striation, that on the vertex close and even. Head behind the eyes smooth except for a trace of striation along the occipital margin. Vertex with hardly a trace of a posterior declivous surface. Base of the ocellar triangle distinctly longer than its sides.

Thorax: Pronotal keel feeble, widely fused medially with the posterior margin of the pronotum; in front of this keel stands another which is well developed and might be mistaken for the true pronotal keel; lateral area moderately well defined. Mesonotum somewhat depressed, not raised high above the level of the pronotum, anteriorly sloping rather gradually to the pronotum; its sculpture consists of rather rough glistening scaly-reticulation; there is a considerable amount of raised sculpture posteriorly but the posterior carinae are completely broken up; notaulices present but feeble. Scutellum almost flat, completely margined laterally, scaly-reticulate. Basal carina of the propodeum about as long as its forks; areola complete but somewhat irregular above; dorsal areas somewhat shining, rather vaguely scaly-reticulate. Postscutellum with a small medial tooth. Except for the furrow, which is finely transversely striate, the mesopleura is predominantly scaly-reticulate all over. Submedian cell of the fore-wing only slightly constricted; 2nd abscissa of the radius about $1\frac{1}{2}$ times as long as the 1st; nervus parallelus interstitial. Hind coxa roundly angled at base; hairs of the upper surface of the hind tibia not longer than its middle width; apical lobe without a complete row of spines, 4 on one leg, 2 on the other; hind tarsus 1 twice 2; 3 clearly shorter than 5.

Abdomen: Petiole short, only a little longer than the propodeum, 5 : 6, weakly striate. Tergite (2 + 3) very finely striate; a clearly delimited basal area is present; owing to the pale colour of this tergite its sculpture could be described as subscaly-reticulation; beyond the basal area the sculpture is similar but finer; no trace of a differentiated lateral margin; epipleura of tergite (2 + 3) shining, with an area of microscopic punctation corresponding to each morphologically true segment. Following tergites almost entirely smooth. Ovipositor sheaths about $\frac{2}{3}$ the length of the gaster.

Length: 3·5 mm. without ovipositor.

MALAYA: Singapore, 1 ♀ (*Baker*).
Type in U.S. National Museum.

Spathius fragilis sp. n.

♀. Body entirely reddish-yellow. Palpi whitish-yellow. Flagellum embrowned towards apex, the more basal segments without a dark apical ring. Legs more yellowish in tint than the thorax; hind tibiae whitish at base, but this is by no means striking owing to the pale colour of the rest of the tibia. Fore-wing almost hyaline; hardly a trace of clouding.

Head transverse, clearly a little narrower behind the eyes than across them. Face evenly convex and having a satiny sheen; its sculpture consists of excessively fine, absolutely even, transverse aciculation, like the surface of a gramophone record; against the inner eye-margin and towards the cheeks, this sculpture becomes gradually coarser and less close; the area occupied by specialised aciculation is not at all raised above the surface along the inner eye-margin as in *urios* sp. n. Frons smooth. Vertex almost smooth, only the merest trace of transverse aciculation present. Antenna with 25 segments; flagellum 1 not longer than scape plus pedicel. Ocelli arranged almost in an equilateral triangle.

Thorax rather narrow in profile. Pronotal keel free, widely separated from the posterior margin of the pronotum, obliterated where it should curve downwards and backwards on the sides of the pronotum and hence showing as a short brownish transverse crest; lateral area feebly defined. Mesonotum sloping gradually to the pronotum (fig. 193), its hairs very sparse and restricted more or less to the course of the notaulices; these well defined, hardly rugulose; posterior carinae straight and even (otherwise hardly a trace of raised sculpture on the mesonotum posteriorly); lobes everywhere with a sculpture of glistening subscaly-reticulation. Scutellum almost flat, sculptured like the mesonotum, margined laterally. Postscutellum in profile with a sharp dentiform process. Propodeum with only a trace of a basal carina and areola in the type, but virtually without these in the paratype; dorsal areas faintly shining, more or less scaly-reticulate everywhere. Hind coxa simple; hind femur rather stout; hairs of the upper surface of the hind tibia slightly shorter than its middle width; apical lobe without spines; hind tarsus 1 twice as long as 2. Wings like those of *urios*.

Abdomen: Petiole $1\frac{1}{2}$ times as long as the propodeum, finely striate-rugose, the longitudinal element not very obvious, except apically. Tergite (2 + 3), in the type, with a basal area of fine aciculation which is concentric about the mid-basal point; beyond this area there is a short surface of excessively fine sculpture, apparently aciculation but hardly resolvable at a magnification of × 60; apical third of this segment together with the broad lateral margin entirely smooth; in the paratype, the sculptured area is larger, dull and merely extremely finely rugulose; epipleura of tergite (2 + 3) entirely smooth and shining. Following tergites completely smooth and shining. Ovipositor sheaths a little shorter than the gaster.

Length: about 3 mm. without ovipositor.

PHILIPPINES: Mindanao, Butuan, 1 ♀, the type; Luzon, Mt. Makiling, 1 ♀, paratype (*Baker*).

Type in U.S. National Museum.

This species is much like *urios* sp. n., but differs in having the palpi entirely pale, the area occupied by specialised aciculation not raised above the surface along the eye-margin, the pronotal keel free and the sculpture of tergite (2 + 3) different.

Spathius fragilis sp. n. may be only small examples of a larger species but its characters seem good enough to justify the use of a specific name.

Group of *vulnificus* Wilkinson.

Characters: Species of very generalised appearance; pale to medium brown; legs predominantly pale, that is, honey-yellow to honey-brown. Fore-wings not dappled with black and white, feebly shaded in parts, as is shown in fig. 227.

Head not or only a little narrower behind the eyes than across them. Face covered with fine absolutely even transverse aciculation, resembling the surface of a gramophone record (fig. 201). Vertex with fine striation or almost smooth. Mesonotum falling vertically or at least sloping fairly abruptly to the pronotum. Pronotal keel feeble, either touching the posterior margin of the pronotum or medially fused with it. Notaulices complete throughout. Wings sometimes vestigial; medius taking at most only a slight downward curve just beyond middle; 2nd abscissa of the radius not or only slightly longer than the 1st intercubitus. Hind coxa with a distinct basal projection. Petiole short, rather strongly elbowed at base when seen from the side.

INDIA. Three species.

In the highly specialised sculpture of the face this group resembles the group of *rusticulus*, but otherwise the two groups appear to be quite dissimilar. It is possible that the facial character appeared early in the evolution of the SPATHIINAE and has retained its identity in two lines of descent which seem now to have otherwise little in common.

Key to the species of the *vulnificus* group.—Females.

1. Wings vestigial. (Yellowish-brown species with the abdomen except tergite (2 + 3) which is pale in part, blackish; tergite (2 + 3), except for the narrow apical margin, finely, longitudinally striate) . *critolaus* Nixon.
–. Wings fully developed . . . . 2.
2. Tergite (2 + 3) dull, extremely closely reticulate, appearing finely rugulose, almost shagreened. (Sp. with tergite (2 + 3) having the basal half entirely yellow and a yellowish spot on each side of apical half) . *sul* sp. n.
–. Tergite (2 + 3) differently sculptured . . . . 3.
3. Tergite (2 + 3) with a yellowish semicircular area at base which is finely, more or less obliquely aciculate; beyond this area almost smooth; 2nd abscissa of the radius of the fore-wing only slightly more than half the length of the 3rd. (Ovipositor longer) . . . . *vulnificus* Wilkinson.
–. Tergite (2 + 3) yellowish at base but without this colour being restricted to a semicircular area; in greater part, finely longitudinally striated; 2nd abscissa of the radius about $\frac{2}{3}$ the length of the 3rd. (Ovipositor shorter) *critolaus* Nixon.

Spathius vulnificus Wilkinson.

Spathius vulnificus Wilkinson, 1931, *Trans. ent. Soc. Lond.* **79** : 516, ♀.

♀. Head evenly honey-brown; mesonotum same colour as the head; rest of thorax suffused with darker colouring, especially the scutellar region and sides and posterior face of the propodeum; the dorsal surface of the propodeum is more reddish in tint than the mesonotum; petiole much the same colour as the dorsal surface of the propodeum; base of the gaster with a rather sharply defined honey-brown to honey-yellow basal area; otherwise dark shining brown to blackish. All the coxae honey-brown to honey-yellow; except that the hind femora are usually infuscated towards apex, the legs throughout are honey-brown to honey-yellow. Palpi pale yellow. Fore-wings shaded with darker colouring as in fig. 227.

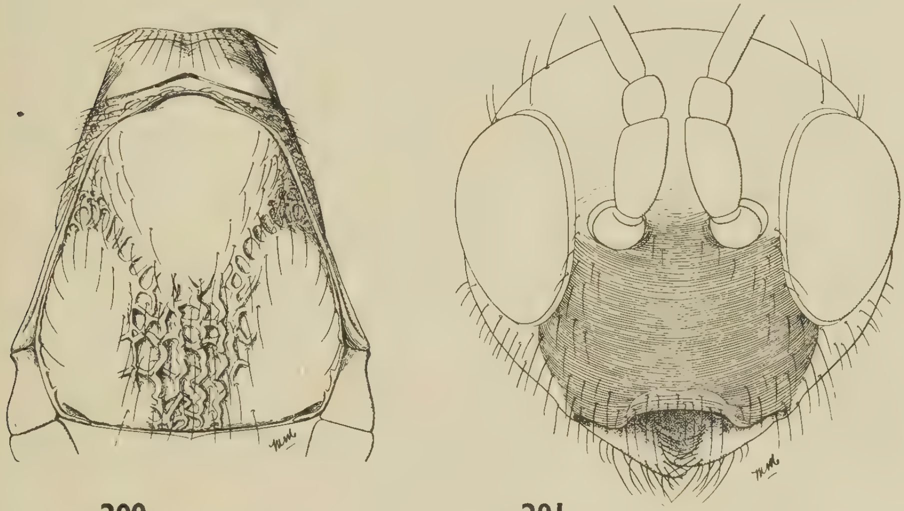
Head transverse, as wide behind the eyes as across them, sometimes very slightly narrower. Frons and vertex transversely striated; the striation on vertex sometimes rather feeble and not reaching the eye-margin. Antenna with 26–31 segments; flagellum 1 as long as scape plus pedicel. Base of the ocellar triangle clearly longer than its sides.

Thorax: Pronotal keel feeble, widely fused with the posterior margin of the pronotum; lateral area indicated but ill defined. Mesonotum falling almost vertically to the pronotum; lobes shining, with a subscaly-reticulation; notaulices shallow, feebly costate; posterior carinae fairly well defined but usually broken. Scutellum flattened, scaly-reticulate. Postscutellum medially without pubescence. Propodeum: basal carina about as long as its forks but these usually ill defined and broken; dorsal areas with feeble broken reticulation spreading over about basal $\frac{1}{2}$ or less; otherwise with shining scaly-reticulation. Mesopleural furrow with rather fine striation; disc shining and almost smooth. Wings (fig. 227). Legs: front tarsus hardly longer than its tibia, about 37 : 35; hind coxa with a feeble projection at base; hairs of the upper surface of the hind tibia semi-erect, about as long as its middle width; hind tarsus 1 twice 2.

Abdomen: Petiole a little less than twice the length of the propodeum, rather broad, strongly elbowed at base when seen from the side; except within the apical dilatation, striate-reticulate, but the striate element by no means marked. Tergite (2 + 3) with very fine, broken aciculation which tends to be concentric about the mid-basal point and which extends only a little beyond the pale basal area; in kind, direction and intensity, the sculpture here seems to be very unstable [a single female (Jawalpur, Saharanpur (*Bhatia*), ex *Dendrocalamus strictus*) has the pale area of tergite (2 + 3) covered in greater part with vague reticulation; the dark apical part of the segment is also reticulated, but vaguely and finely]. Following tergites virtually smooth. Sides of tergite (2 + 3) without a trace of a margin; its epipleura with the merest trace of punctation, visible at × 60. Ovipositor sheaths slightly longer than the gaster.

Length: about 4·5 mm. without ovipositor.

♂. Like the female, but paler in colour, the thorax almost entirely honey-brown. Sometimes there is no definite aciculation at the base of tergite (2 + 3), the sculpture being broken up to form predominantly a kind of subscaly-reticulation with an element of feeble aciculation in it.



200 **201**

Figs. 200–201.—200. *Spathius trophonius* sp. n., mesonotum; 201. *S. vulnificus* Wilkinson, head, from in front.

Length: about 3 mm.

India: Bengal; Bombay; Central Provinces; United Provinces; Central Provinces; Madras.

Hosts: Species of *Dinoderus* and probably other Bostrychidae; it has been bred from *Dendrocalamus strictus* (bamboo) attacked by *Dinoderus brevis* Horn, *D. minutus* Fabr., and *D. ocellaris* Steph. It has been bred under artificial conditions from the weevils, *Pempherulus affinis* Fst. and *Hypolixus truncatulus* Fab. in Madras, Coimbatore (Krishna Ayyar and Narayanaswami, 1940) (see p. 177).

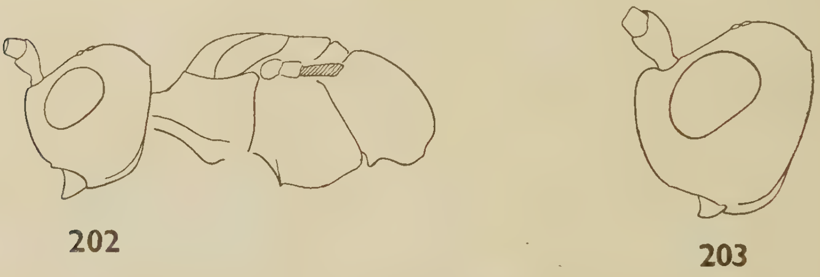
Type in British Museum (Natural History).

A series from Assam, Goalpara, 24 ♀♀, 15 ♂♂, x–xi.1932 (D.F.C. Coll.), differs from typical *vulnificus* as follows:—average size smaller, the female being about 3·5 mm., without ovipositor; colour more extensively honey-brown, the thorax being entirely of this colour; base of tergite (2 + 3) often without the delimited pale area so characteristic of typical *vulnificus*; sculpture much less evident here, often almost absent; vertex only feebly striated, sometimes completely smooth in both sexes; short, spurious vein at apex of the mediellan cell distinctly antefurcal. The only character here which might fall outside the range of specific variation is the venational one; the other details, *i.e.*, greater extent and diffusion of pale colouring and weaker sculpture are probably natural correlations of the diminution in size.

Spathius critolaus Nixon.

Spathius critolaus Nixon, 1939, *Bull. ent. Res.* **30** : 119, ♂♀.

♂♀. Head, thorax and petiole reddish-brown to yellowish-brown in the ♀, yellowish-brown in the ♂; basal third of tergite (2 + 3) more or less same colour as the paler parts of the body; this pale area is more extensive and more sharply defined in the ♂ than in the ♀. Palpi pale yellow. Antennae markedly yellowish, the last 5 or 6 segments darkened so that the flagellum appears finely ringed with black. Legs more or less honey-brown, with the femora (especially the hind pair) slightly darkened on anterior and posterior sides; the legs of the ♂ are paler, but the hind femora usually show a dark patch on each side; coxae of both sexes unicolorous whether pale or dark.



Figs. 202–203.—202. *Spathius critolaus* Nixon, head and thorax; 203. *S. sul* sp. n., head, lateral.

♀. Macropterous. *Head* at most very slightly narrower behind the eyes than across them. Vertex almost smooth, at most with traces of transverse aciculation. Ocelli in a triangle with base clearly longer than sides. Antennae broken in the type series but 25-segmented in a single female from the Punjab; flagellum 1 slightly longer than scape plus pedicel, 10 : 9.

Thorax: Pronotal keel very feeble, medially fused with the posterior margin of the pronotum. Mesonotum with a few long outstanding hairs, its lobes feebly shining, vaguely scaly-reticulate. Propodeum without a distinct basal carina and areola, hence without delimited dorsal areas; the surface everywhere irregularly rugose. Mesopleura with some sort of sculpture virtually everywhere; the furrow showing as a broad, shallow impression crossed by striation which extends beyond its limits (the single female from the Punjab has the mesopleura much less extensively sculptured but nowhere is the surface completely smooth). Radius arising distinctly from beyond the middle of the stigma, its 2nd abscissa as long as or slightly longer than the 1st intercubitus. Hind coxa with a distinct projection beneath at base; lobe of the hind tibia with a row of fine spines; hairs of its upper surface much shorter than its middle width; hind tarsus 1 twice 2; 3 a little shorter than 5.

Abdomen: Petiole short, twice as long as its apical width, rugose but becoming striate on apical $\frac{1}{3}$. Tergite (2 + 3) with fine striation almost to apex; this striation is predominantly longitudinal, except perhaps towards its apical limits where laterally it tends to be curved. Ovipositor sheaths a little shorter than the gaster. Length: 2·8–3·1 mm., without ovipositor.

♀. Micropterous (fig. 202). In the type series, the great majority of the specimens are of this form. The mesonotum is small by comparison with that of a fully winged female. Fore-wing reduced to an elongate, scaly-like stump which reaches to about the anterior margin of the propodeum.

♂. Micropterous. All the males are of this form in the type series. Antenna 24-segmented (1 ♂). Wing as in female.

♂. Macropterous. Males belonging to the series from the Punjab. Tergite (2 + 3), in addition to being pale at base, shows a yellowish spot on each side more apically; the longitudinal sculpture of this segment tends to be broken up, in places, into scaly-reticulation; as in the type series, the sculpture, of whatever kind, extends almost to apex. Basal carina and areola of the propodeum fairly well developed; but the single micropterous female in the series is like the females from S. India. Hairs of the upper surface of the hind tibia longer and more numerous than in the micropterous males of the type series.

Length: ♂, 2·5–2·9 mm.

S. INDIA: Madras, Coimbatore; Malabar; Erode; Ramnad (*P. N. Krishna Ayyar*). Punjab, Chichawatni, 16 macropterous ♂♂, 1 micropterous ♀, bred from seeds of *Prosopis spicigera* (*S. D. Bhatt*).

Hosts: The cotton-stem weevil, *Pempherulus affinis* Fst. and also, but to a less extent, *Hypolixus truncatulus* Fab. (CURCULIONIDAE) and *Sinoxylon sudanicum* Lesne (BOSTRYCHIDAE).

Type in British Museum (Natural History).

This species is certainly very closely related to *vulnificus* which, as far as I know, is always fully winged in both sexes. Where macropterous forms of *critolaus* are concerned, the sculpture of tergite (2 + 3) provides the most reliable criterion for separating the two species.

For a complete account of the biology of this species see Krishna Ayyar (1940); see also p. 177.

Spathius sul sp. n.

Differs from *vulnificus* as follows:—

♀. Colour more extensively honey-brown, the thorax having no dark suffusion anywhere; tergite (2 + 3) on basal half yellowish and with a yellow patch of irregular shape on each side of the apical half; tergites 6 and 7 in greater part yellow. Flagellum yellow throughout, but the more apical segments faintly tipped with black; the apical 5–6 segments are more clearly yellow than those preceding. Hind tibiae honey-yellow on apical half, whitish at base and with a wide brownish band varying in definition, slightly proximal to middle.

Face more prominent, the eyes slightly smaller (fig. 203). Frons and vertex almost smooth, only the merest trace of fine, transverse striation being present. Segment 1 of the flagellum not longer than 2; in *vulnificus* it is slightly longer.

Pronotal keel close to the posterior margin of the pronotum but not touching it. Sculpture of the mesopleura finer, subscaly-reticulate, there being but little raised rugosity even within the subalar impression. Fore-wing: darkened areas more extensive, the wing being markedly infumated; radius leaving stigma farther beyond the middle; 2nd cubital cell longer; 1st abscissa of the radius shorter; 2nd abscissa distinctly longer than the 1st transverse cubitus; recurrens entering the 2nd cubital cell slightly nearer the 1st transverse cubitus.

Tergite (2 + 3), except for the narrow apical margin, extremely finely reticulated, virtually without longitudinal elements in its sculpture. Ovipositor sheaths slightly shorter than the gaster plus petiole. Length: about 4 mm. without ovipositor.

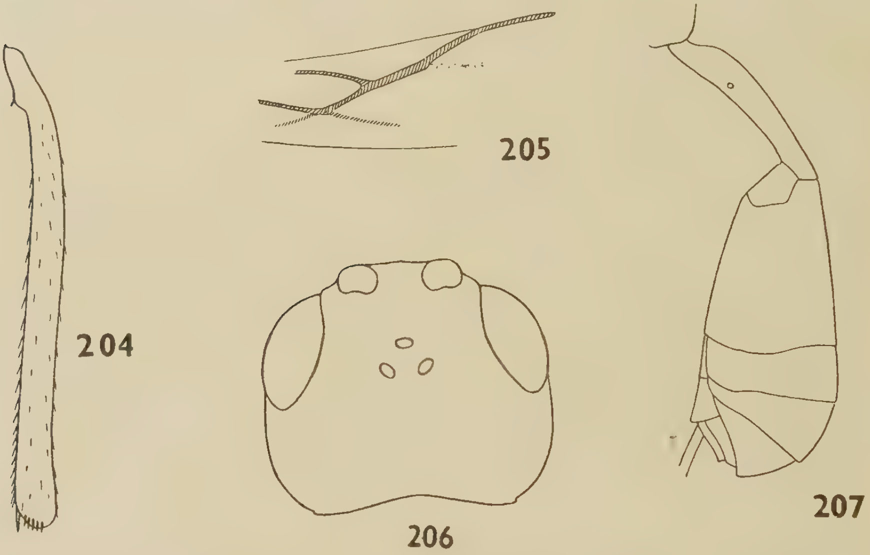
♂. Like the female but more delicate in build. Sculpture of tergite (2 + 3) less definite.

INDIA: Dehra Dun, Jhajra, 3 ♀♀, 1 ♂, 27–29.iii.1928 (type female, 28.iii.1928), " ex *Grewia vestita* " (*C. F. C. Beeson*), 1 ♀, 5.iv.1929 (*J. C. M. Gardner*); Dehra Dun, 1 ♀, 30.x.1924, " ex *Pinus longifolia* " (*F. R. I. Compound*).

Type in British Museum (Natural History).

This species differs at once from both *critolaus* and *vulnificus* by the sculpture and pattern of tergite (2 + 3).

Group of **berlandi** sp. n.



FIGS. 204–207.—*Spathius berlandi* sp. n.:—204. hind tibia; 205. part of hind-wing; 206. head, dorsal; 207. abdomen, lateral.

Spathius berlandi sp. n.

♀. Body on the whole uniformly dark brown but the head slightly paler than the thorax; this is only just apparent to the naked eye. Antennae broken but the flagellum yellowish towards base, the segments faintly ringed with black apically. Palpi dark brownish. Legs more or less uniformly brownish; the shade of brown much the same as that of the head. Fore-wings strongly brownish with, to the naked eye, a conspicuous, sharply delimited hyaline fascia cutting base of stigma; there is a hyaline patch in the widest part of the median cell but this patch does not extend into the submedian cell.

Head markedly subcubical (fig. 206) and as wide behind the eyes as across them. Face rather finely aciculate-rugose, the sculpture not obliterated medially, where there is hardly a trace of an elevation. Frons finely aciculate, the aciculation tending to be somewhat concentric with regard to the antennal insertions. Vertex very shining, with only the merest trace of transverse aciculation. Ocellar triangle small, placed far forward on the vertex (see fig. 206); the ocelli small, arranged almost in an equilateral triangle. Eyes rather small, their longer axis twice the length of the malar space. Antenna broken; flagellum 1 a trifle shorter than scape plus pedicel, 10 : 13; hairs of at least the first 9 flagellar segments (rest broken) very short and quite inconspicuous, the segments appearing at first sight almost bare.

Thorax: Pronotal keel not developed; lateral area not delimited. Mesonotum very shining, covered all over with somewhat obsolescent scaly-reticulation; strongly gibbose in front, the middle lobe falling perpendicularly to the pronotum and with prominent rounded " shoulders "; notaulices indicated on the lateral declivous sides of the mesonotum as very deep, but feebly costate furrows; on the disc they fade out completely; the posterior part of the mesonotum is quite deeply hollowed out between the lateral lobes but shows no trace of raised rugosity; hairs fine, almost recumbent, very few in number and easily overlooked. Scutellum only very slightly convex, shining, feebly sculptured. Propodeum somewhat elongate, virtually without areation, finely rugose-reticulate, but anteriorly, on either side of the hardly indicated basal carina, becoming much more shining and nearly smooth. Mesopleura strongly shining and almost smooth everywhere; the furrow extremely weakly indicated in one female, absent in the other. Lobes of the mesosternum separated by a very deep, wide, smooth channel. Legs: hind coxa roundly angled at base; hind tibia slender, smooth and bare along upper surface, elsewhere with extremely short, more or less adpressed hairs (fig. 204); apical lobe with about 5 irregular spines, difficult to see; hind tarsus 1, 3 times as long as 2; 3 a trifle more than half 5, 5 : 9. Wings: submedian cell of the fore-wing strongly constricted at middle; recurrens received into the 2nd cubital cell at a distance from the 1st intercubitus equal to nearly its own length; nervus parallelus more or less interstitial; radiella of hind-wing leaving the subcostella far beyond apex of mediellan cell (fig. 205).

Abdomen: Petiole narrow, parallel-sided, twice as long as the propodeum, finely rugose, becoming almost smooth just beyond middle and, dorsally at least, virtually without longitudinal elements. Gaster dull (fig. 207), covered all over with an excessively fine, quite indeterminate surface sculpture, the tergites having a greasy appearance; tergite (2 + 3) without a trace of lateral margin. Ovipositor sheaths longer than the whole body, 13 : 9.

Length: 4·5 mm. without ovipositor.

MADAGASCAR: 2 ♀♀, one the type (*J. de Gaulle*, 1919).

Type in British Museum (Natural History).

This is an isolated species, quite unlike any other I have dealt with in this monograph. Possibly it is derived from the same ancestral stock which produced the *dissors*-group; there are certain features in common such as :—yellow flagellum annulated with black; absence of raised sculpture on the posterior part of the mesonotum; unareated propodeum; patterned fore-wing and excessively fine sculpture of gaster. The facies, however, is different, especially in regard to the subcubical head and the strongly gibbose anterior lobe of the mesonotum; these two characters together with the absence of a properly defined mesopleural furrow, channelled mesosternum and long 1st segment of the hind tarsus render the species very distinctive.

Group of *apotanus* Wilkinson.

Spathius apotanus Wilkinson.

Spathius apotanus Wilkinson, 1931, *Trans. ent. Soc. Lond.* **79** : 509, ♂♀.

♀. Micropterous species. Largest individuals are more or less evenly dark brown but smaller specimens are paler and have a yellowish tint although the gaster remains darker than the rest of the body. Apical 7–9 segments of the flagellum bright yellowish. Palpi brownish. Hind coxae more or less bicolorous, the basal half, more especially beneath, being pale to yellowish; the remaining part brown like the body; all the femora unicolorous, brown; tibiae brown but darker in tint than the femora and more or less colourless at extreme base.

Head very slightly narrower behind the eyes than across them. Face evenly scaly-reticulate, without a trace of striation. Frons and vertex shining, showing traces of scaly-reticulation. Antenna with 26–30 segments; flagellum 1 as long as scape plus pedicel; hairs of the flagellum bristly, fully half as long as the width of the segments. Eyes small, 1½ times as long as the malar space. Ocelli very small, arranged in a triangle with base much longer than sides.

Thorax (fig. 209): Pronotum greatly prolonged and seen from above, almost as long as the mesonotum, 13 : 17, dull, closely scaly-reticulate, almost shagreened but with a variable amount of transverse striation on the collar; pronotal keel not differentiated as such. Mesonotum small, dull, with a ground sculpture like that of the pronotum, and with a few long, outstanding hairs; notaulices represented at each "shoulder" by a wide shallow impression margined in front; posteriorly the mesonotum is without raised rugosities. Scutellum dull, scaly-reticulate, conically raised (fig. 210), its anterior depression divided more or less into two slightly shining elongate foveae. Propodeum large, dull, covered with the prevailing surface sculpture and with a variable amount of raised rugosity, more especially on sides and posterior face; no delimited areas present. Metapleura evenly scaly-reticulate. Mesopleural furrow not delimited as such, its place taken by a wide shallow depression crossed by strong carination; disc a little raised, dull, evenly scaly-reticulate. Legs: hind coxa with a feeble projection beneath at base; hind tibia swollen on basal half, the hairs of its upper surface almost recumbent, shorter than its middle width; hind tarsus 1 about 2½ times as long as 2; 3 hardly more than half 5. Fore-wing represented by a narrow, elongate, pointed scale which is nearly half the length of the mesonotum.

Abdomen: Petiole narrow, with prominent spiracles, dull, covered with a variable amount of obsolescent longitudinal carination; surface of the gaster faintly matt, appearing greasy owing to the presence of an indeterminate roughness. Ovipositor sheaths about as long as abdomen plus propodeum.

Length: 2–4 mm. without ovipositor.

♂. Like the female, apart from the sexual differences, but colour paler, almost fulvous yellow, except for the gaster; this paleness of colour may be only a correlation of the small size of the specimens available.

South Africa: C.P., Pondoland, Port St. John, Oct.–April, 6 ♂♂, 22 ♀♀ (*R. E. Turner*).

Type in British Museum (Natural History).

It is probable that this species is related to the *dissors*-group. Significant points of resemblance seem to be:—dark palpi, bicolorous hind coxae, unicolorous hind femora and faintly dull gaster.

Spathius apotanus Nixon subsp. **laevior** subsp. n.

♀. Differs from the typical form in the reduction of raised rugosity on the thorax and especially in the form of the scutellum; this has a sharper, more erect conical projection (fig. 208); there is no trace of an anterior depression to the scutellum, the surface everywhere in front of the projection being dull and evenly scaly-reticulate. Mesopleural furrow much less strong, its carination feeble and almost obsolescent.

S. Africa: Zululand, Eshowe, 23–31.iii.1926, 2 ♀♀, one the type (*R. E. Turner*).

Type in British Museum (Natural History).

Group of *cursor* Wilkinson.

Spathius cursor Wilkinson.

Spathius cursor Wilkinson, 1931, *Trans. ent. Soc. Lond.* **79** : 508, ♀.

♀. Micropterous species. Pale yellowish-brown with the gaster darker; sometimes the head, thorax and petiole are darker brown with a faint reddish tint. Palpi pale yellowish throughout. Apical 6–7 segments of the flagellum yellow. Hind coxae and hind femora brownish or yellowish-brown throughout; hind tibiae more or less honey-brown, faintly paler at extreme base.

Head markedly narrower behind the eyes than across them (fig. 211). Face shining, smooth-looking, with a vague surface sculpture and traces of delicate transverse wrinkles. Frons and vertex with feeble much-broken striation mixed with vague scaly-reticulation, the effect being one of fine rugosity. Ocelli moderately large, larger and more conspicuous than in *apotanus* Wilk. Antenna with 22–24 segments (4 ♀♀); flagellum 1 longer than scape plus pedicel, 11 : 8; hairs of the more basal segments bristly, curved, fully equal to the width of the segments. Eyes small, their longer axis only a trifle longer than the malar space, 9 : 8.

Thorax: Pronotum half as long as the mesonotum, with much raised rugosity; pronotal keel not differentiated. Mesonotum small, its hairs very sparse and outstanding; lobes rugulose; notaulices fairly deeply impressed, made up of a number of large, somewhat smooth, ill-delimited foveae; posteriorly the mesonotum shows one or two short rugae. Scutellum almost flat, its anterior depression represented by two large circular shining foveae. Propodeum completely areated, not disproportionately large in comparison with the size of the thorax; basal carina about twice as long as its forks; areola and area petiolaris confluent; dorsal areas dull, evenly shagreened; rather prominent posterior protuberances present. Mesopleural furrow wide, ill delimited, smooth with strong transverse costae; disc dull, shagreened all over. Fore-wing vestigial, reaching the middle of the propodeum. Legs: hind coxa with feeble projection; hind tibia swollen on about basal half; hairs of its upper surface outstanding, clearly longer than its narrowest width; apical lobe without spines; hind tarsus 1 a trifle less than twice 2, 13 : 7; 3 to 5 as 9 : 11.

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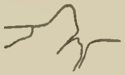

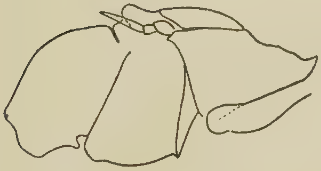

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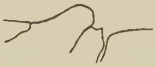

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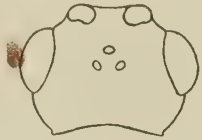

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FIGS. 208–211.—208. *Spathius apotanus* Wilkinson, subsp. *laevior* subsp. n., postscutellum, in profile; 209. *S. apotanus* Wilkinson, thorax, lateral; 210. *S. apotanus*, postscutellum in profile; 211. *S. cursor* Wilkinson, head, dorsal.

Abdomen: Petiole 1½ times as long as the propodeum, rugulose and with rather feeble longitudinal ridges. Gaster smooth and shining. Ovipositor sheaths about as long as the gaster.

Length: 2·5–2·7 mm. without ovipositor.

S. AFRICA: C.P., Pondoland, Port St. John (*R. E. Turner*).

Type in British Museum (Natural History).

This species is not at all closely related to *apotanus* and is probably derived from a different stock; it can at once be distinguished from *apotanus* by a number of characters, chief among which are :—(1) shape of head, (2) shorter pronotum, (3) simple scutellum, (4) areated propodeum and (5) shorter ovipositor.

Group of **turneri** sp. n.

Spathius turneri sp. n.

♀. A dark brown, shining little species, the body clothed with long, almost erect hairs. Antenna dull brownish-yellow, becoming a little darker towards apex. Palpi dirty yellow. Hind coxae dark brown; hind trochanters whitish-yellow; hind femora brown, not quite so dark as their coxae and very faintly paler at base; hind tibiae brown with a more or less colourless post-basal band.

Head, seen from above, almost spherical, slightly narrower behind the eyes than across them. Face shining, with somewhat obsolescent scaly-reticulation. Frons with vague subscaly-reticulation. Vertex almost smooth; traces of wide-meshed scaly-reticulation occur towards eyes and temples; the meshes of the reticulation are inclined to be elongate in the transverse direction. Ocelli small, indistinct, arranged in triangle with base much longer than sides. Eyes large, their longer axis twice the length of the malar space. Antenna with 22 segments; flagellum very slender; segment 1 a trifle longer than scape plus pedicel, 9 : 8; flagellar vestiture conspicuous, the hairs of at least the more basal segments fully equal to the width of the segments.

Thorax : Pronotum $\frac{2}{3}$ as long as the mesonotum, 7 : 10, strongly shining, with indefinite, somewhat weak but raised rugosities; pronotal keel not differentiated. Mesonotum very small, with a feeble medial carina and on each side of this shallowly hollowed out, the resulting cavity strongly shining and almost smooth; these smooth impressions almost certainly represent the notaulices which have lost their furrow-like character and have developed as wide impressions; posteriorly on each side is a dull triangular area of scaly-reticulation which represents (taxonomically) the lateral lobes. Scutellum small, the shield itself diamond-shaped and, seen from above, almost flat; seen from the side, however, it is feebly conical in a backward direction. Propodeum divided into a dorsal and posterior face; the dorsal surface long, medially with a fine keel which extends to its posterior limit; on each side of the keel the surface is strongly shining and almost smooth; the areas thus formed not bounded laterally by a keel as is usual in *Spathius* and consequently embracing the spiracles; areola situated on the posterior face, feebly defined, narrow, confluent with area petiolaris. Mesopleura coarsely scaly-reticulate. Legs : hind coxa with weak basal projection; hind tibia distinctly swollen on basal half, the hairs of its upper surface long, erect, about $2\frac{1}{2}$ times its middle (narrowest) width; hind tarsus 1 twice 2; 3 is $\frac{2}{3}$ of 5. Wings vestigial, the front pair in the form of a narrow, pointed scale which is about as long as the scutellum plus postscutellum.

Abdomen : Petiole $1\frac{1}{2}$ times as long as the propodeum; towards base shining and nearly smooth; towards apex with feeble longitudinal elements. Gaster smooth and shining, its hairs, like those of the petiole, sparse and erect. Ovipositor sheaths about as long as the whole abdomen.

Length : 2·2 mm. without ovipositor.

AUSTRALIA : S.E. Queensland, Tambourine Mts., 18–25.v.1935, 1 ♀, the type (*R. E. Turner*).

Type in British Museum (Natural History).

This is an isolated and interesting little species, largely characterised, so far as I am able to conjecture, by the sculpture of the mesonotum and of the propodeum and by its vestiture of long hairs.

Group of *labdacus* Nixon.

Characters :—Species of variable form, the head and thorax sometimes extraordinarily flattened; intergrades occur between this extreme modification and a more generalised form such as is shown by *labdacus* Nixon.

Head always at least slightly flattened dorso-ventrally so that the eyes are somewhat obliquely placed and appear large when the head is seen from above. Vertex always with some kind of sculpture. Pronotal keel either free, prominent and sharp, or free but forming the crest of a strong transverse swelling. Hairs of the mesonotum long, sparse and outstanding; posterior part of the mesonotum always with raised rugosity. Propodeum elongate, its areation feeble and incomplete; basal carina at least as long as its forks; areola and area petiolaris confluent. Fore-wings strongly dappled (fig. 212); the submedian cell is distinctly constricted just beyond middle and is crossed by a broad hyaline fascia at its narrowest. Hind coxa simple; hind femur in profile with its upper edge strongly curved, the femur thus abruptly narrowed at base; hind tibia rather thick, its apical lobe with 4–5 rather inconspicuous spines. Petiole dull, closely rugulose, its longitudinal elements in the form of short broken wrinkles, inconspicuous and never showing as smooth ridges. Tergite (2 + 3) dull, evenly shagreened all over; laterally with a differentiated margin extending to about the second spiracle; tergite 4 without a differentiated margin but its epipleura sometimes so sharply deflexed as to suggest the presence of one. Ovipositor sheaths at most hardly longer than the whole abdomen.

All the trochanters, hind coxae, all the femora and all the tibiae evenly brown (but see below, *tereus* sp. n., end); front and middle coxae a little paler than the hind pair, more or less honey-brown. At least the basal segment of the palpi blackish.

INDIA. MALAYA. BORNEO. PHILIPPINES. Three species.

The essential characters of the group are :—colour of legs, structure of pronotum and of legs, dappling and venation of fore-wing and sculpture of tergite (2 + 3). Except in the degree to which dorso-ventral compression takes place, the species form a very homogeneous unit.

Key to the species of the *labdacus* group.—Females.

1. Thorax very strongly flattened, its length, seen from side, from apex of pronotum to posterior end of propodeum, 5 times as great as its depth at the tegulae; head, in profile, greatly flattened (fig. 215) *tereus* sp. n.
–. Thorax much less flattened and, thus seen, its length at most $3\frac{1}{4}$ times as its depth at the tegulae; head at most slightly flattened . . . . 2.
2. Pronotal keel sharp, trenchant; ovipositor sheaths fully as long as the whole abdomen . . . . *labdacus* Nixon.
–. Pronotal keel not as above, the pronotum strongly, transversely swollen and surmounted by the obsolescent pronotal keel; ovipositor sheaths hardly $\frac{2}{3}$ as long as the whole abdomen . . . . *ochus* sp. n.

Spathius labdacus Nixon.

Spathius labdacus Nixon, 1939, *Bull. ent. Res.* **30** : 121, ♂♀ (figs.).

♂♀. Reddish-brown with the abdomen blackish; there seems to be variation in the colour of the thorax, small individuals tending to have this part darker than larger ones. Maxillary palpi blackish with the apical segment whitish. Antennae yellowish, darkened towards apex. All the coxae and femora reddish-brown like the thorax; trochanters and tibiae much the same colour as the femora but both sometimes blackish in small examples; middle and front tarsi yellowish with the apical segment darkened; hind tarsi usually darkened with only the base of the basal segment yellowish. Fore-wing as in fig. 212.

Head decidedly a little flattened dorso-ventrally, though there is some variation (fig.

216). Face reticulate-rugose. Frons and vertex covered all over with fine, transverse broken striation, the rugulosity of the sculpture being characteristic. Temples and cheeks rugose-striate; in smallest individuals the cheeks tend to become smooth towards the occipital margin. Vertex not rounded behind, the uppermost point of the occipital margin and the ocelli lying almost in the same plane. Antenna with 35–39 segments; flagellum 1 a trifle shorter than scape plus pedicel, 9 : 10.

Thorax (fig. 216): Pronotal keel well developed, free, raised above the level of the posterior margin of the pronotum. Mesonotum sloping gradually to the pronotum; lobes in far greater part covered wih close scaly-reticulation, feebly shining; notaulices somewhat superficial; posterior ridges nearly parallel, sometimes broken; hairs sparse, outstanding. Scutellum evenly convex, scaly-reticulate. Propodeum: basal carina usually about as long as its forks but sometimes ill defined and broken; dorsal areas with fine surface sculpture anteriorly but merely rugose posteriorly. Mesopleura immediately adjacent to the crenate-rugose furrow, sometimes nearly smooth but more often scaly-reticulate; subalar impression of the mesopleura weakly pubescent. Hind leg (fig. 213); segment 1 of the hind tarsus slightly more than twice 2, 17 : 8; 3 a little shorter than 5, 5 : 6.

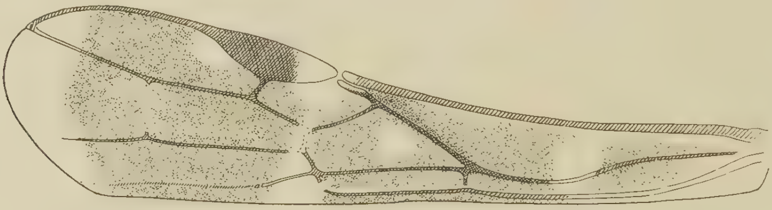

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FIG. 212.—*Spathius labdacus* Nixon, fore-wing, ♀.

Abdomen: Tergite (2 + 3) as long as apically wide, its sculpture on basal half slightly coarser than that on the apical half. Ovipositor sheaths about $1\frac{1}{3}$ times as long as the whole abdomen.

♂. Antenna with 36–42 segments. In small examples, the basal carina of the propodeum and its forks may be broken up and lost in the surrounding rugosities.

Length: ♂♀, 3·5–4·1 mm., without ovipositor of female.

SOUTH INDIA: Coimbatore, bred from *Pempherulus affinis* Fst., in *Triumfetta rhomboidea* (*P. N. Krishna Ayyar*).

Type in British Museum (Natural History).

Important for the recognition of this species are the form of the pronotal keel and the convex scutellum.

Spathius ochus sp. n.

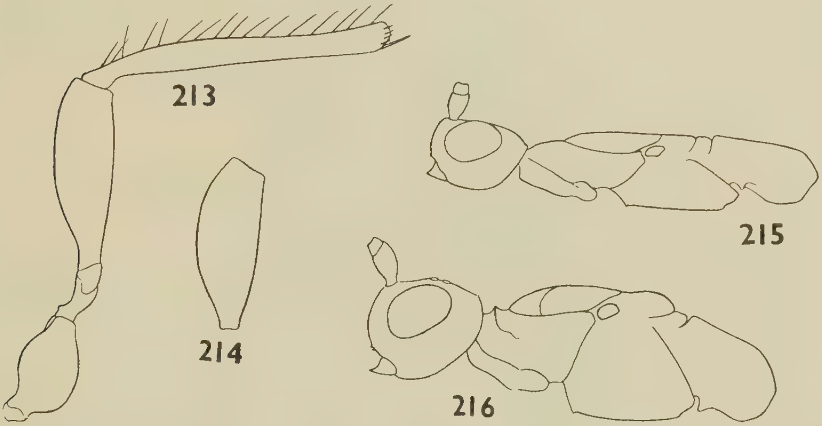
This species may be compared with *labdacus* as follows:—

♀. Head and thorax considerably compressed dorso-ventrally. Sculpture of the vertex finer, the striate element much less in evidence. Eyes slightly more obliquely placed. Ocelli in an equilateral triangle; in *labdacus* the base of the triangle is quite distinctly longer than its sides.

Thorax, seen from the side from apex of pronotum to posterior end of propodeum, about 3 times as long as deep at the tegulae. Pronotum transversely swollen just behind middle, the swelling surmounted by the obsolescent pronotal keel; in *labdacus* the keel is sharp and trenchant. Posterior carinae of the mesonotum rather weak; sometimes there are 2 or 3 similar keels, but more wrinkly, on either side of the two main keels. Scutellum quite flat. Propodeum duller, more finely and evenly sculptured; dorsal areas not differentiated, open behind. Mesopleural furrow usually very shallow, at most very feebly costate. Hind femur stouter (fig. 214). Epipleura of tergite (2 + 3)–6 much more sharply reflexed. Ovipositor sheaths hardly $\frac{2}{3}$ as long as the whole abdomen.

BORNEO: Sandakan, 1 ♀ (*Baker*). PHILIPPINES: Mindanao, Zamboanga, 3 ♀♀, one the type (*Baker*). I. of Biliran, 1 ♀ (*Baker*). I. of Basilan, 1 ♀ (*Baker*). SUNDA ISLANDS: Sumbawa, 24–25.vi.1927, 1 ♀ (*Rensch*).

Type in U.S. National Museum.



FIGS. 213–216.—213. *Spathius labdacus* Nixon, hind leg, ♀; 214. *S. ochus* sp. n., hind femur, ♀; 215. *S. tereus* sp. n., head and thorax, lateral; 216. *S. labdacus* Nixon, head and thorax, lateral.

Spathius tereus sp. n.

♀. Extremely like *ochus* but differing from that species by being much more compressed dorso-ventrally (fig. 215). In a lateral view the thorax is 5 times as long as deep. The mesonotum is remarkably flattened and posteriorly, within the area occupied by raised rugosity, slightly depressed.

♂. Like the female except for the sexual differences.

PHILIPPINES: Mindanao, Butuan, 1 ♀, the type (*Baker*); Zamboanga, 1 ♂ (*Baker*). I. of Basilan, 2 ♀♀ (*Baker*).

Type in U.S. National Museum.

I have been rather puzzled by two females from Sandakan and Singapore, which are much paler than the nominotypical form; the entire body is fulvous-red with the propodeum a little darkened in the specimen from Sandakan; in both females the legs are entirely pale, the normal brown being replaced by dull yellow. Only more material can decide whether these females represent a geographical race of *tereus* or not.

Group of *ruficeps* Smith.

Characters: Head usually as wide behind the eyes as across them, rarely slightly narrower; sometimes slightly wider. Vertex with strong, on the whole smooth striation, except in *sucro* sp. n., and *caicus* sp. n.; in *tenedos* sp. n., the striation is somewhat feeble and in *chrysogonus* sp. n., it occurs only on the anterior part of the vertex. Hairs of the flagellum extremely short and inconspicuous; sparse or nearly absent on the inner curved side of segment 1.

Pronotal keel well developed, free. Mesonotum sometimes sloping abruptly but never falling perpendicularly to the pronotum, its hairs sparse, outstanding. Basal carina of the propodeum at least as long as its forks. Wings (fig. 225). Apical lobe of the hind tibia with a complete row of spines; all the tibiae clothed with long erect hairs, the longest of which are equal to at least the middle width of the tibia; hind coxa simple beneath at base. Gaster, except in *ruficeps* Smith, always with aciculation at least on the broad apical margin of the segments.

INDO-AUSTRALIAN region. Nine species, one subspecies and one variety.

Although I have taken the name of the group from *ruficeps* Smith, as this is the oldest described species, this insect is not the most characteristic member of the group and in several respects is isolated from its allies.

I have seen the types of *ruficeps*, *apicalis* and *femoralis*.

Key to the species of the *ruficeps* group.—Females.

1. Hind tibiae dark throughout . . . . 2.
–. Hind tibiae pale basally (usually on about basal $\frac{2}{5}$) . . . . 5.
2. Tergite (2 + 3) about as long as its apical width, appearing still longer; head usually contrasting red; petiole very long and narrow, markedly narrower in apical half than in basal half . . . . 3.
–. Tergite (2 + 3) clearly transverse; head never contrasting red; petiole much shorter . . . . 4.
3. Tergite (2 + 3) without parallel aciculation; both trochanters of the hind leg dark; pronotal keel very strongly developed, almost angled laterally *ruficeps* Smith.
–. Tergite (2 + 3) at least on apical half with fine, parallel aciculation; basal trochanter of the hind leg pale; pronotal keel less strongly developed, rounded laterally . . . . *priapus* sp. n.
4. Vertex sharply and, on the whole, smoothly striate . *apicalis* Westwood
–. Vertex transversely striate-rugose . . . . *sucro* sp. n.
5. Vertex very finely rugose-striate. (Very small sp., 3 mm., with the hind tibiae pale only on about basal $\frac{1}{6}$) . . . . *caicus* sp. n.
–. Vertex with only smooth striation . . . . 6.
6. Vertex smooth except for fine striation immediately behind the ocelli. (Head black; thorax and petiole entirely reddish) . *chrysogonus* sp. n.
–. Vertex striated all over . . . . 7.
7. Lateral lobes of the mesonotum with only a narrow, longitudinal band of fine surface sculpture, otherwise covered with strong transverse rugae; dorsal areas of the propodeum usually covered all over with shining rugose-reticulation . . . . *femoralis* Westwood.
–. Lateral lobes of the mesonotum with the greater part of their surface covered with scaly-reticulation; dorsal areas of the propodeum in far greater part scaly-reticulate, dull . . . . 8.
8. Tergite (2 + 3) shining and with feeble, smooth aciculation; head, seen from above, somewhat flattened, almost circular in outline . . *tenedos* sp. n.
–. Tergite (2 + 3) dull, its aciculation tending to be broken up to form fine rugulosity; head, seen from above, not in the least flattened, transverse *olynthus* sp. n.

Spathius ruficeps Smith.

Stenophasmus ruficeps Smith, 1858–59, *Proc. Linn. Soc. (Zool.)* **3** : 170.
Spathius ruficeps Sm., Szepligeti, 1904, *Gen. Ins.* (*Braconidae*) : 53.
Stenophasmus ruficeps Sm., Enderlein, 1912, *Arch. Naturgesch.* **78** (A2) : 9.
Spathius ruficeps Sm., Wilkinson, 1931, *Trans. ent. Soc. Lond.* **79** : 521.

♀. Brownish-black to black, the head contrasting red; tergite 7 with a more or less distinct broad yellowish apical band. Palpi obscurely yellowish, the basal segments a little infuscated. Hind legs (except tarsi, which are brownish-yellow), dark brown. Post-tegulae brown or blackish.

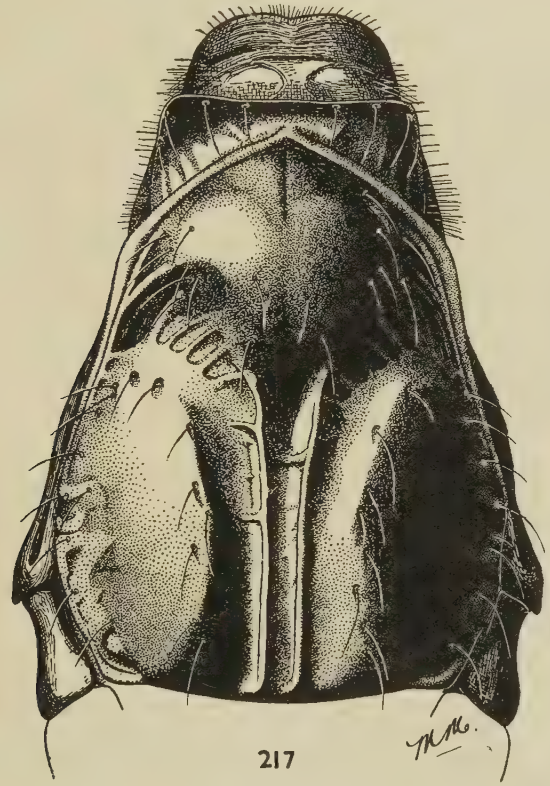


FIG. 217.—*Spathius ruficeps* Smith; pro- and mesonotum.

Head as wide behind the eyes as across them. Face rather finely transversely rugose. Vertex and head behind the eyes strongly striate. Base of the ocellar triangle clearly longer than its sides.

Thorax: Pronotal keel very strongly developed, its dorsal edge not forming with the lateral edge an even curve but roundly angled laterally. Mesonotum (fig. 217): lateral lobes much raised longitudinally, sloping abruptly to the course of the notaulices, which are very smooth and virtually without costae; their smoothness is a characteristic feature of the species; the two posterior carinae are without the usual, short, lateral branches, are even, more or less parallel and stand out sharply against their smooth background. Dorsal areas of the propodeum with a fine surface sculpture over most of their surface. Lower half of the metapleura with dense silvery pubescence. Subalar impression of the mesopleura without sharp longitudinal striation, covered with dense silvery pubescence; furrow long, narrow, almost smooth. Recurrens of the fore-wing somewhat vertically placed, almost interstitial. Front tarsus about 1½ times as long as its tibia; hind femur somewhat gradually narrowed to base; hairs of the upper surface of the hind tibia more or less erect, fully twice its middle width; segment 1 of the hind tarsus a little less than twice 2, about 9 : 5; 3 as long as 5.

Abdomen: Petiole very long, about 3 times as long as the propodeum, noticeably constricted before apex, its sculpture somewhat obsolete. Tergite (2 + 3) without aciculation anywhere, slightly less than basal half is fairly sharply delimited by being more strongly sculptured than the rest of the segment; the surface of this area is extremely finely and evenly punctate-reticulate; sculpture of apical part of the segment essentially of the same kind but weaker; it could be described as extremely close scaly-reticulation, especially towards the sides; the epipleura of tergite (2 + 3) in no way delimited. Following tergites with a sculpture similar to that of the apical part of (2 + 3). Tergites 5 and 6 with a double row of long cilia, the basal row very irregular; basal to this row is another, usually incomplete row of shorter cilia; this third row is usually more complete on tergite 5 than on 6. Ovipositor sheaths a little shorter than thorax plus abdomen.

Length: 7–11 mm. without ovipositor.

♂. Like the female but smaller, the cilia of the apical tergites much less conspicuous. Tergite (2 + 3) about 1½ times as long as its greatest width; its sculpture is like that of the female but less definite.

PHILIPPINES: Mindanao, Butuan, 10 ♀♀ (*Baker*); Kolambugan, 2 ♂♂; Iligan, 2 ♂♂ (*Baker*). Negros, Cuernos Mts., 1 ♀ (*Baker*). I. of Basilan, 3 ♀♀, 2 ♂♂ (*Baker*). ARU IS. (type loc.).

Type in Hope Department, University Museum, Oxford.

Spathius ruficeps Sm., subsp. **unicolor** subsp. n.

This seems to be a well-defined colour form with a different distribution, and deserves, I think, a name. It differs from typical *ruficeps* in having the head not paler than the thorax to the naked eye. On the whole most of the individuals are smaller and paler in colour than the nominate form, those from Sandakan, in particular, being uniformly medium brown.

Length: 5·5–10 mm. without ovipositor.

JAVA: Semarang, 2 ♀♀, one the type, 1 ♂, Teak Forest (*Kalshoven*); Jelawa, 10 ♀♀, 11 ♂♂ (*Kalshoven*). BORNEO: Sandakan, 13 ♀♀, 1 ♂ (*Baker*); Kuching, 1 ♀; Kariorang, 1 ♀ (*Walsh*); Tangarang, 1 ♀ (*Walsh*); Sarawak, 1 ♀; Sarawak, foot of Mt. Dulit, 1 ♂ (*B. M. Hobby & A. W. Moore*).

Type in British Museum (Natural History).

Spathius ruficeps Sm. var. **pallida** var. n.

♀. Head, thorax, petiole uniformly fulvous; gaster blackish. Antenna with 68 segments. Impressions of the notaulices *between* the lateral lobes with transverse costae branching off from the posterior mesonotal carinae. Pubescence of the subalar impression of the mesopleura shorter and less thick.

Length: about 8 mm. without ovipositor.

PHILIPPINES: Luzon, Mt. Makiling, 1 ♀ (*Baker*).

This is a very striking-looking insect and might possibly be better regarded as a subspecies of the nominotypical species.

Type in U.S. National Museum.

Spathius priapus sp. n.

♀. Blackish-brown to black with the head reddish or brownish-red. Front and middle coxae pale yellowish; all the femora and tibiae brown to blackish throughout; tarsi, except the apical segment, yellowish-brown. Fore-wing, except for a faint and very narrow transverse hyaline fascia at middle, without any marked contrast of darker and paler patches such as occur in *apicalis* for example, the wing becoming progressively paler towards the apex. Palpi pale yellow. Antennae brownish-yellow, darkened towards apex. Post-tegulae yellowish.

Head: Vertex and head behind the eyes with strong smooth striation. Face transversely rugose. Base of the ocellar triangle clearly longer than its sides. Antenna very long and slender, with about 60 segments; in small examples with as few as 53; flagellum 1 considerably longer than scape plus pedicel, 17 : 12.

Thorax: Pronotal keel well developed, free. Mesonotum sloping gradually to the pronotum; lobes shining, with a very fine, somewhat broken scaly-reticulation; posterior carinae with short lateral branches forming the costae of the notaulices. Propodeum: basal carina fully as long as its forks though these are usually ill defined; dorsal areas not delimited posteriorly, their surface mostly finely reticulate-rugose; areola, when defined, usually with a few transverse ridges. Metapleura below beset fairly thickly with minute brownish hairs. Mesopleura usually smooth above the furrow, but sometimes the costae of the furrow extend upwards over the medial part of the disc, leaving no extensive polished surface; subalar impression with strong, longitudinal striation, its pubescence thin. Position of recurrens as in fig. 246. Legs: front tarsus about $1\frac{2}{3}$ as long as its tibia; hind femur not very abruptly narrowed at base; hairs of the upper surface of the hind tibia $1\frac{1}{4}$ to $1\frac{1}{2}$ times its middle width; segment 1 of the hind tarsus almost exactly twice as long as 2; 3 as long as 5.

Abdomen: Petiole twice as long as the propodeum, reticulate-rugose with a transverse tendency, except anterior to spiracles and apically. Tergite (2 + 3) longer than its apical width, about 45 : 38; a slight difference in sculpture divides the segment into two areas, the basal shorter than the apical; the apical area is covered right up to the apex with smooth parallel aciculation, transverse and anteriorly concentric; the basal area has either aciculation which is roughened and, at least laterally, continuous with that of the apical area, or merely a finely rugose sculpture with at most a transverse tendency. Following tergites smoothly transversely aciculate; 5 and 6 virtually with a single row of cilia. Ovipositor sheaths about as long as the body.

Length: 5·5–9 mm. without ovipositor.

♂. Tergite (2 + 3) slightly more than twice as long as its apical width, divided by a difference of sculpture into two areas, the basal one *longer* than the apical; the basal area is very finely punctate-reticulate while the apical one is finely rugose with a transverse aciculate tendency towards apex.

Length: about 5·2 mm.

BORNEO: Sandakan, 10 ♀♀, 2 ♂♂. PHILIPPINES: Mindanao, Surigao, 2 ♀♀; Zamboanga, 8 ♀♀ (*Baker*). Negros, Cuernos Mts., 26 ♀♀, one the type (*Baker*). I. of Samar, 1 ♀ (*Baker*). I. of Basilan, 2 ♀♀, 1 ♂ (*Baker*).

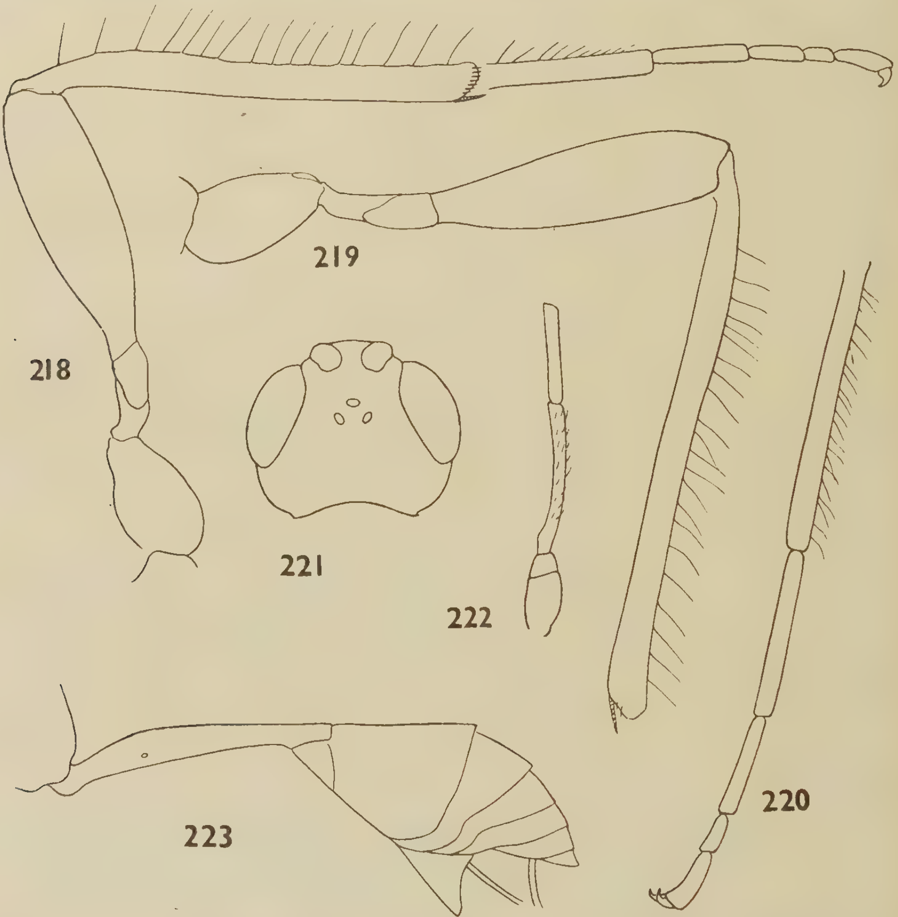
Type in U.S. National Museum.

This is a very distinctive species, resembling *ruficeps* Sm. because of its slender form but differing from that spcies, *inter alia*, in the sculpture of the mesonotum and of tergite (2 + 3). The long first segment of the gaster will separate it from all the other members of the group.

Spathius apicalis Westwood.

Spathius apicalis West., 1882, *Tijdschr. Ent.* **25** : 43, ♀.
Spathius festinans Wilkinson, 1931, *Bull. ent. Res.* **22** : 261, ♂♀.

♀. Dark brown, almost black, the head paler; small individuals are decidedly brown to the naked eye. Front and middle coxae whitish or yellowish; the hind pair dark, taking on the predominating colour of the body; apical trochanter of the hind leg dark like the hind femur; all the femora and tibiae unicolorous, blackish or brownish, according to whether the individual is pale or dark in colour; sometimes, even in dark examples, the femora and tibiae have a slight reddish tint; tarsi somewhat yellowish. Palpi darkened, but the apical one or two segments of the maxillary palpi pale. Fore-wing much darkened, pale at apex and with a hyaline fascia at base cutting the submedian cell at about middle and another cutting the wing at base of stigma (fig. 225).



Figs. 218–223.—218. *Spathius apicalis* West., hind leg, ♀; 219 & 220. *S. belisareus* sp. n., hind leg, ♀; 221. *S. tenedos* sp. n., head, dorsal; 222. *S. sucro* sp. n., 4 basal antennal segments; 223. *S. arcesius* sp. n., abdomen, lateral.

Head sometimes very slightly narrower behind the eyes than across them, 34 : 33, but usually more or less exactly as wide. Face transversely rugose. Frons, over most of its surface, showing transverse striation which is often broken up into irregular rugosity. Striation of vertex, where it curves at the top of the eye, broken up to form a small patch of coriaceous sculpture. Head behind the eyes with smooth striation similar to that on the vertex. Antenna with 42–50 segments; flagellum 1 about 1½ times as long as scape plus pedicel, 17 : 12. Base of the ocellar triangle considerably longer than its sides.

Thorax: Pronotal keel raised above the level of the posterior margin of the pronotum; lateral area moderately well defined, its transverse ridges decidedly obsolescent. Mesonotum sloping gradually to the pronotum; lobes almost all over with a scaly-reticulation which varies in sharpness and tends to be broken up on the middle lobe; posterior carinae with short, branching costae which do not extend beyond the lateral limiting margin of the notaulices; sometimes they are almost absent. Disc of the scutellum almost flat, sculptured like the lobes of the mesonotum. Propodeum: dorsal areas over most of their surface showing a fine almost scaly-reticulate sculpture; posteriorly, where the areas are not always well defined, the surface tends to be covered with irregular carinulae; areola usually present but not always sharply defined. Mesopleura dull and with some kind of sculpture all over; the surface immediately adjacent to the furrow above and towards front tends to become smooth, but the scaly-reticulation is always indicated; the subalar impression is vaguely striated and covered fairly thickly with pale pubescence, but this is not dense enough to obscure the sculpture of the surface beneath. Front tarsus nearly twice as long as its tibia, about 65 : 36; segment 1 of the hind tarsus less than twice 2, 28 : 17; 3 exactly as long as 5; hairs of the upper surface of the hind tibia a little longer than its middle width, about 7 : 5; hind tarsus 1 with long outstanding hairs above, restricted usually to basal half (fig. 218).

Abdomen: Petiole less than twice as long as the propodeum, about 50 : 27, predominately finely rugose with a tendency towards striation at sides and on apical third. Tergite (2 + 3) transverse and at base with an indistinct, more or less semicircular area (or an area which is at least longer medially than at sides); this area is differentiated from the surface outside it by being slightly more strongly sculptured, the sculpture often evenly rugulose but sometimes with indication of fine concentric broken aciculation; rest of the tergite very finely rugulose with a tendency towards concentric aciculation which is most in evidence towards the apical corners and along the apical margin of the segment; there is a good deal of variation and in Indian examples (*festinans* Wilkinson), tergite (2 + 3) is predominately aciculate and often shows hardly a trace of rugulosity. Normally the visible surface of tergites 4–7 sculptured like the apical half of (2 + 3). Tergites 5–7 with a medial band of long cilia. Ovipositor sheaths a little longer than gaster plus petiole.

Length: 4·5–7 mm. without ovipositor.

INDIA: Dehra Dun, Phanduwala, 2 ♀♀, " ex *Bauhinia variegata* "; Lachiwala, 1 ♀, " ex *Odina wodier* ". Bihar & Orissa, Singbhum, 1 ♀, " ex *Mangifera indica* ", bred in association with *Camptarrhinus mangiferae* Mshl. (CURCULIONIDAE). Bengal, Chittagong, 2 ♀♀; Darjeeling, 1 ♀, " ex *Bombax malabaricum* ". Bombay, Kanara, 2 ♂♂, " ex *Grewia tiliaefolia* ". ANDAMANS: 4 ♀♀, " ex Lekok & *Dipterocarpus turbinatus* ". MALAYA: Sepang, 1 ♀; Singapore, 1 ♀. JAVA: 3 ♀♀. BORNEO: Sarawak (type locality); Sandakan, 36 ♀♀. PHILIPPINES: Luzon, Mt. Makiling, 1 ♀. Mindanao, Zamboanga, 60 ♀♀, 7 ♂♂; Davao, 3 ♀♀; Dapitan, 2 ♀♀. Negros, Cuernos Mts., 4 ♀♀. I. of Basilan, 10 ♀♀. N.W. Panay, 1 ♀. CHINA: Tonkin, 1 ♀. FORMOSA: 3 ♀♀.

Type in Hope Department, University Museum, Oxford.

I have a single small female from Australia (N. Queensland, Kuranda, 1100 ft., vi–vii.1913, *R. E. Turner*) which I believe to be *apicalis* in spite of certain differences; this insect is small and shows a lack of definition both in colour and sculpture. It differs from typical *apicalis* in having the gaster more shining; tergite (2 + 3) has an extremely vague sculpture; on basal $\frac{2}{5}$ it is predominately aciculate and has more or less longitudinal direction but elsewhere the segment appears faintly roughened. The specimen is of further interest because it is one of the only three species of *Spathius* that I know to occur in Australia; the other two being *S. turneri* sp. n. and *S. kurandaensis* sp. n.

Spathius apicalis Westwood appears to be the commonest and certainly the most widely distributed species of the genus in the Indo-oriental region. It is essentially characterised by its entirely dark hind tibiae and the sculpture of tergite (2 + 3).

Spathius apicalis Westwood subsp. **glabra** subsp. n.

This appears to be a well-defined subspecies of *apicalis,* having the hind tarsus more slender and its basal segment without outstanding hairs. The ovipositor is also longer, the sheaths being slightly longer than the abdomen plus propodeum.

PHILIPPINES : Mindanao, Kolambugan, 2 ♀♀, one the type (*Baker*).
Type in U.S. National Museum.

Spathius olynthus sp. n.

This and the next species, *S. femoralis* West., have two characters in common, both of which separate them from *apicalis*; the head behind the eyes is smooth and the basal $\frac{1}{3}$ to $\frac{2}{5}$ of the hind tibiae are whitish testaceous.

S. olynthus differs from *apicalis* as follows :—

♀. Average size smaller, 3·5–6 mm. Head distinctly narrower behind the eyes than across them, smooth behind the eyes. Pro- and mesonotum slightly less elongate, the slope of the mesonotum in front slightly steeper; lobes of the mesonotum duller, their surface sculpture being a little stronger; the costae that branch off from the posterior carinae are stronger and on the whole slightly longer; in consequence, the notaulices appear more strongly costate than in *apicalis.* Hairs of the upper surface of the hind tibia slightly shorter; hind femur more shining; front tarsus less long in proportion to its tibia, about 31 : 22. Petiole slightly wider and with the striate element more in evidence, especially on apical third.

Paler in colour, the whole body, even in largest individuals, suffused with red-brown. Hind femora usually markedly reddish, paler than the dark part of their tibiae; hind tarsal segment 1 whitish only at extreme base. Fore-wing paler, not showing the same contrast of light and shade; the pale apex of the wing less sharply delimited than in *apicalis* (cf. fig. 225).

BORNEO : Sandakan, 15 ♀♀, one the type (*Baker*). PHILIPPINES : Negros, Cuernos Mts., 1 ♀. Mindanao, Zamboanga, 5 ♀♀ (*Baker*).
Type in U.S. National Museum.

Spathius femoralis Westwood.

Spathius femoralis West., 1882, *Tijds. v. Ent.* **25** : 43, ♀.

This species is extremely closely related to *olynthus* and may be compared with that species as follows :—

♀. Colour variable but on the whole paler, most individuals appearing brown to the naked eye rather than blackish; the type appears blackish and has the femora contrasting reddish; the femora are much the same colour in the material from the Philippines, though the contrast is much less sharp. Basal segment of the hind tarsus whitish on about basal half; in the type only at extreme base; in the type also, the white base of the middle and front tibiae is prolonged along the upper side of the tibia as a whitish streak; at most a trace of this is to be seen in the Philippine material.

Lateral lobes of the mesonotum showing only a narrow band of fine sculpture, the surface on each side of this band covered with coarse wrinkly rugosities; those on the inner side are a lateral extension of the costae of the notaulices. Dorsal areas of the propodeum covered all over with shining reticulate-rugosity, which often shows a transverse tendency; at most the merest indication of the fine, dull, scaly-reticulation characteristic of both *olynthus* and *apicalis*. Mesopleura more strongly sculptured, strong carinae spreading upwards from the furrow and covering the whole of the disc. About apical third of the petiole smoothly striate, the striation characteristically regular. Tergite (2 + 3) even more finely sculptured than in *olynthus*; basal area sometimes merely concentrically aciculate, but sometimes the aciculation broken up to form fine rugosity. I can find no differences here that could be correlated with locality, although in the 6 females from the I. of Sibuyan the basal area tends to be regularly aciculate; the sculpture of the rest of tergite (2 + 3) varies from clear aciculation to fine rugulosity with aciculation in evidence only laterally.

Length: on the average larger than *olynthus*, most individuals between 5·5 and 6·5 mm.

MOLUCCAS: Mysol (type locality). PHILIPPINES: Mindanao, Davao, 1 ♀; Butuan, 1 ♀; Surigao, 3 ♀♀. Negros, Cuernos Mts., 4 ♀♀. I. of Sibuyan, 7 ♀♀. I. of Basilan, 1 ♀. Biliran Is., 1 ♀. Luzon, Mt. Makiling, 2 ♀♀. Los Baños, 1 ♀. NEW GUINEA: Manus, 2 ♀♀ (*N. E. H. Caldwell*); these two females have the body predominantly blackish with the hind femora black-brown; in one female there is a yellowish band across the apex of tergite (2 + 3); the basal tarsal segment of the hind legs is white on fully basal half; gaster beautifully and regularly aciculate.

Type in Hope Department, University Museum, Oxford.

Spathius femoralis seem to be characterised by the sculpture of the mesonotum and of the propodeum.

Spathius sucro sp. n.

♀. Blackish-brown with the head dull red-brown. All the tibiae dark brown throughout; the femora slightly paler with more red in the composition of the colour; tarsi paler than their tibiae. Palpi whitish-yellow.

Head slightly wider behind the eyes than across them. Vertex dull, rugose-striate, the sculpture becoming finer against the eye-margin above. Head behind the eyes with a sculpture similar to that of the vertex. Base of ocellar triangle less long than in *apicalis* and *olynthus*. Flagellum 1 unusually long, nearly twice as long as scape plus pedicel, 7 : 4, and without hairs on its inner curved side (fig. 222).

Thorax: Mesonotum sloping somewhat abruptly to the pronotum; lateral lobes with only a narrow medial band of fine sculpture, the rest of the surface being covered with irregular raised rugosities; notaulices deep, broad, rather sharply demarcated, evenly costate throughout; the entire mesonotum, apart from the notaulices, has a glistening, almost granulate appearance; this seems to be due to the fact that the surface sculpture is very close, irregular and overlies the raised rugosities of all three lobes. Pronotal keel free, but not widely so. Scutellum markedly convex. Sculpture of the dorsal areas of the propodeum reduced to scaly-reticulation on anterior half. Disc of the mesopleura adjacent to the furrow, shining and with vague scaly-reticulation, but tending to become quite smooth. Front tarsus not much longer than its tibia, about 35 : 43; hairs of the upper surface of the hind tibia about $1\frac{1}{4}$ times as long as its middle width; hind tarsus 1 slightly less than twice 2, 21 : 11; 3 as long as 5; hind tarsus 1 with outstanding hairs above.

Abdomen: Petiole rugose all over, without smooth striation at apex, but with feeble broken longitudinal wrinkles here. Basal area of tergite (2 + 3) finely rugose; rest of segment similarly but more finely sculptured; excessively fine aciculation in evidence only along apical margin and towards apical corners. Ovipositor sheaths very slightly shorter than the whole abdomen.

Length: 4·8–5·5 mm. without ovipositor.

Borneo: Sandakan, 4 ♀♀, one the type (*Baker*).

Type in U.S. National Museum.

Although this species lacks the characteristic pale base of the hind tibia of *olynthus* and *femoralis* and in this respect is like *apicalis*, I think it is more closely related to the two former species than to the latter, having in common with them a stouter, more robust form than *apicalis*. Specifically, *sucro* seems to be easily distinguishable by the sculpture of the head. The sculpture of the mesonotum is like that of *femoralis*, though rougher; while the sculpture of the petiole is not different from that of *apicalis*.

Spathius chrysogonus sp. n.

Differs from *apicalis* as follows:—

♀. Head black; thorax and petiole dull yellowish-red; dorsal surface of the gaster brownish but extreme base of tergite (2 + 3) becoming red like the petiole; the broad apical margin of the tergites paler, yellowish and somewhat transparent in appearance; ventral surface of the gaster entirely yellow on about basal $\frac{2}{3}$. Hind coxae brown, but paler at base above; hind tibiae whitish-yellow on about basal $\frac{1}{3}$, then dark brown and on rather more than apical $\frac{1}{3}$ fading to honey-yellow; apical trochanter of the hind leg suffused with reddish; basal segment of the hind tarsus darkened, the remaining segments more or less yellowish. Palpi whitish-yellow. Wings more evenly tinted, the median cell evenly pale, more or less hyaline, throughout.

Head a trifle narrower behind the eyes than across them, 19 : 20. Face more coarsely rugose, the transverse element less pronounced. Frons smoothly striate. Vertex finely striated on apical $\frac{1}{4}$, otherwise smooth, shining. Antenna broken but with at least 45 segments; flagellum 1 a little longer than scape plus pedicel, 23 : 18.

Dorsal areas of the propodeum everywhere with fine, transverse, somewhat confluent striation. Disc of the mesopleura shining and almost smooth. Recurrens received into the 2nd cubital cell at a distance from the 1st intercubitus equal to about $\frac{1}{3}$ its own length.

Aciculation of the gaster rather more distinct than in most examples of *apicalis*. Ovipositor sheaths almost as long as thorax plus abdomen.

Length: 8·8 mm. without ovipositor.

Borneo: Sarawak, 1 ♀.

Type in British Museum (Natural History).

Differs from all the other members of the group in colour and in having the greater part of the vertex smooth. Because of the pale base of the hind tibia it is probably more closely related to *femoralis* and *olynthus* than to *apicalis*.

Spathius caicus sp. n.

♀. Brown with either a ferrugineous tint (as in type) or a yellowish tint (as in unique paratype); cheeks slightly darkened in the type. Palpi pale yellow. Scape and pedicel yellow; flagellar segments 3–4 yellowish, the segments thence becoming brown. Middle coxae honey-yellow; hind coxae brownish; front coxae intermediate in colour between the two other pairs; in the paratype, the front coxae virtually the same colour as the middle pair; all the femora brownish; tibiae more or less brownish, the middle and hind pairs whitish at base.

Head very slightly narrower behind the eyes than across them. Face with fine, broken transverse striation. Vertex somewhat dull, very finely transversely rugulose-aciculate all over; towards the occipital margin and temples the aciculation is more in evidence and is smoother. Antennae very slender, with 27 segments in the type (broken in paratype); flagellum 1 considerably longer than scape plus pedicel, 11 : 7, virtually without hairs on its inner curved side. Base of the ocellar triangle clearly longer than its sides.

Thorax: Pronotal keel clearly defined, medially narrowly fused with the posterior margin of the pronotum; lateral area clearly defined. Mesonotum falling fairly abruptly but not vertically to the pronotum; its sculpture very glistening and on the far greater part of the lobes fine and rather characteristic, more especially on the middle lobe; the edges of the meshes of the scaly-reticulation are so raised that the sculpture is describable as excessively finely reticulated; the meshes themselves are shining; the lateral lobes are similarly but slightly more finely sculptured, appearing almost rugulose; notaulices well defined; posterior carinae poorly defined; hairs very sparse. Scutellum dull, hardly convex, weakly margined laterally. Basal carina and areola of the propodeum very feebly indicated; dorsal areas indicated by a large tract of fine rugosity. Mesopleura dull, sculptured all over; in the postero-ventral corner, there is a small patch of fine scaly-reticulation; elsewhere the surface is covered with irregular rugosities. Front tarsus virtually twice as long as its tibia, 44 : 23; hairs of the upper surface of the hind tibia about as long as its middle width; hind tarsus 1 less than twice 2, 18 : 11; 3 as long as 5. Medius of the fore-wing markedly sinuate, the submedian cell hence slightly constricted beyond middle.

Abdomen: Petiole 1½ times as long as the propodeum, rather slender, finely rugose-reticulate on basal ⅔ and with a well-marked longitudinal element on about apical third. Tergite (2 + 3) with a satiny sheen, covered with excessively fine, slightly broken aciculation which tends to be concentric about the mid-basal point; this sculpture is not readily resolvable at a magnification of ×75; epipleura of tergite (2 + 3) shining, with a medial area of hardly visible punctation (×75). Ovipositor sheaths slightly longer than the gaster.

Length: 3 mm. without ovipositor.

PHILIPPINES: Luzon, Mt. Makiling, 1 ♀, the type (*Baker*). Mindanao, Zamboanga, 1 ♀, paratype (*Baker*).

Type in U.S. National Museum.

This species resembles *sucro* in having a long first flagellar segment and the striation of the vertex not smooth; it differs from *sucro* in being much smaller, in having the base of the hind tibiae pale and the aciculation of tergite (2 + 3) smooth.

Spathius tenedos sp. n.

♀. Head and thorax red-brown; propodeum and gaster darker brown. Palpi pale yellow. Front and middle coxae pale brown; hind coxae darker, opaque; hind tibiae pale on about basal ⅖. Wings almost hyaline; stigma dark but pale on about basal ⅓.

Head very distinctive; seen from above, somewhat flattened dorso-ventrally, almost circular (fig. 221). Vertex with extremely fine transverse aciculation which fades out at the middle line and towards the temples. Eyes rather large. Antenna with 38 segments; flagellum 1 not longer than scape plus pedicel. Base of the ocellar triangle hardly longer than its sides.

Thorax much more elongate than in the *apicalis*-complex. Pronotum with a conspicuous free keel. Mesonotum only very slightly declivous in front; its lobes almost everywhere scaly-reticulate; posterior ridges well defined; hairs very sparse. Propodeum: basal carina fully as long as its forks; areola very feebly defined, narrow; dorsal areas markedly longer than wide, with a fine scaly-reticulation over the greater part of their surface.

Mesopleura virtually smooth medially. Legs: hind femur much swollen, abruptly narrowed at base above, less than twice as long as its coxa, 5 : 3; hairs of the upper surface of the hind tibia about 1¼ times as long as its middle width; apical lobe with a row of minute spines which are difficult to see, even with a magnification of × 60; hind tarsus 1 a little less than twice 2; 3 as long as 5; front tarsus nearly twice as long as its tibia, 11 : 6.

Abdomen: Petiole 1½ times as long as the propodeum, striate-reticulate. Tergite (2 + 3) without a trace of a lateral margin, and with some fine aciculation, which on basal half is more or less longitudinal and stronger than on apical half; on apical half it is more or less concentric about the middle point of the segment; tergites 4–6 with excessively fine, hardly visible, transverse aciculation. Ovipositor sheaths about as long as the whole abdomen.

Length: 3·5 mm. without ovipositor.

BORNEO: Sandakan, 1 ♀ (*Baker*).

Type in U.S. National Museum.

This is an aberrant species and not closely related to the other species of the *ruficeps* group, differing from them all in the shape of the head, the elongate thorax and the swollen hind femur. I am not at all certain that it may not have closer affinities with the group of *labdacus* Nixon on account of these three very features. In the group of *labdacus*, tergite (2 + 3) always has a differentiated lateral margin, extending to at least as far as the second spiracle and the dorsum of this tergite is always without a trace of aciculation. Considerations of convenience have to some extent swayed me in placing *tenedos* with *ruficeps* and its allies and I think its present allocation should be regarded as provisional.

Group of **caenius** sp. n.

Characters:—Large forms, the females 8–11 mm. without ovipositor. Blackish to the naked eye; front and middle coxae brownish; hind tibiae pallid on apical half; tarsi yellowish. Vertex and head behind the eyes with smooth striation. Pronotal keel more or less free but feebly developed. Mesonotum sloping somewhat abruptly to the pronotum, the middle lobe prominently gibbose. Wings (fig. 247). Legs very long and slender; front tarsus a little more than twice as long as its tibia; segment 3 of the hind tarsus about 1½ times as long as 5 and as long as 4 + 5 (fig. 220); apical lobe of the hind tibia without a row of spines, at most 2–3 inconspicuous ones near the shorter spur. Petiole about twice as long as the propodeum. Gaster with a predominating sculpture of fine parallel aciculation. Ovipositor sheaths fully as long as whole body.

Key to the species of the **caenius** group.—Females.

Basal half of tergite (2 + 3) with fine aciculation which is more or less concentric about its mid-basal point; vertex at most with very weak transverse striation on its medial part, but usually smooth; longest hairs of the upper surface of the hind tibia considerably longer than its middle width *belisareus* sp. n.

Basal half of tergite (2 + 3) with fine and, on the whole, longitudinal aciculation; vertex strongly transversely striated; longest hairs of the upper surface of the hind tibia hardly longer than its middle width . . *caenius* sp. n.

Spathius caenius sp. n.

♀. Brownish-black; head and gaster slightly paler, deep brown, but not contrasting with the thorax; post-tegulae brownish. Basal part of the antennae and all the tarsi pale brownish-yellow; hind tibiae on apical half same colour as the hind tarsi but darkened towards base, progressively approaching the colour of the hind femora. Palpi yellow.

Head appearing markedly wider behind the eyes than across them, but on measurement only very slightly wider. Face rugose with a polished, more or less circular area on each side of, and adjacent to, the clypeus. Base of the ocellar triangle clearly longer than its sides. Antenna with 54–57 segments; flagellum 1 about 1½ times as long as scape plus pedicel.

Thorax : Pronotal keel not raised above the posterior margin of the pronotum and often obsolete medially. Lobes of the mesonotum shining, covered with close, indefinite scaly-reticulation; posterior carinae irregular, broken; notaulices costate throughout. Scutellum very feebly convex, feebly scaly-reticulate. Propodeum : basal carina considerably longer than its forks; dorsal areas with irregular rugosities over most of their surface. Lower half of the metapleura with a little thin pubescence. Disc of the mesopleura sometimes polished, sometimes with some feeble rugosities but always much shining. Forewing : stigma rather narrow; recurrens very nearly interstitial (fig. 247). Segment 1 of the hind tarsus less than twice as long as 2 (5 : 6).

Abdomen : Petiole about 2½ times as long as the propodeum, not constricted in apical half, reticulate-rugose with a striate tendency which is most marked at apex. Tergite (2 + 3) divided by a sharp difference in sculpture into two areas; the basal area is shorter than the apical one and its sculpture is fine, even, virtually longitudinal striation, the intervals slightly roughened; the apical area has fine even aciculation which is transverse and straight towards apex but transverse and curved towards base; following tergites with transverse aciculation similar to that of the apical part of (2 + 3). Ovipositor sheaths fully as long as the whole body.

Length : 8·6–11 mm. (without ovipositor); in most cases nearer the larger measurement.

♂. Like the female but differs as follows :—Antenna with 52–54 segments (2 ♂♂). Hairs of the hind tibia slightly longer. Two areas of tergite (2 + 3) equal in length, the sculpture of the basal one being slightly coarser than in the female.

PHILIPPINES : Negros, Cuernos Mts., 10 ♀♀, one the type, 3 ♂♂ (*Baker*). BORNEO : Sandakan, 1 ♀ (*Baker*). The female from Sandakan is small (8·6 mm.) and is altogether paler than the Philippine specimens; the head is contrasting reddish-brown.

Type in U.S. National Museum.

Spathius belisareus sp. n.

♀. This species is very closely related to *caenius*, differing from it as follows :—

Hind tibiae unicolorous, dark brown throughout, though varying in depth of tint; tarsi more yellow.

Frons and vertex almost completely smooth, at most a trace of striation at middle of vertex and towards the temples; the latter sometimes virtually smooth, sometimes with distinct striation. Hairs of the upper surface of the hind tibia longer, hind tarsus with more numerous outstanding hairs (figs. 219 and 220). Tergite (2 + 3) with a much less sharp division into two areas; the basal area with fine aciculation concentric about the mid-basal point; this aciculation is only very slightly stronger than that on the apical part of the segment.

PHILIPPINES : Mindanao, Surigao, 1 ♀, xi.1915 (*Böttcher*); Kolambugan, 2 ♀♀ (*Baker*); Port Banga, xii.1914, 1 ♀, the type (*Böttcher*); I. of Samar, 1 ♀ (*Baker*). BORNEO : Sandakan, 2 ♀♀ (*Baker*). MALAYA : Singapore, 1 ♀ (*F. Smith Coll.*).

Type in British Museum.

The most obvious and perhaps reliable criterion for separating the two species is the sculpture of the basal area of tergite (2 + 3).

Group of *elaboratus* Wilkinson.

Characters: Species of very generalised habitus. Vertex closely striate. Mesonotum falling perpendicularly or almost so to the pronotum, its hairs sparse, outstanding. Hind coxa simple or with a feeble basal projection; apical lobe of hind tibia usually with a complete row of about 7 spines; in one species with only 4 spines. Tergite (2 + 3) without longitudinal elements in its sculpture, evenly and closely punctate-reticulate. Wings (fig. 226).

INDIA. JAVA. BORNEO. PHILIPPINES. SOLOMONS. Four species.

The group is probably fairly closely related to that of *ruficeps* Smith, differing from it chiefly in the shape of the mesonotum in front and the absence of aciculation on the gaster. Such species as *femoralis* West. itself and *olynthus* sp. n., placed in the *ruficeps*-group, have a facies extremely similar to that of the members of the *elaboratus* complex.

Key to the species of the *elaboratus* group.—Females.

1. Hind tibiae pale honey-yellow throughout . . . *chrysippus* sp. n.
–. Hind tibiae pale at most on basal $\frac{2}{5}$ . . . . 2.
2. Clypeus delimited on each side by a very deep cleft. (Dark brown species) *trophonius* sp. n.
–. Clypeus delimited on each side only by a shallow groove. (Spp. with at least the gaster very obviously pale in part) . . . . 3.
3. Hind tibiae pale on at least basal $\frac{2}{5}$; palpi whitish-yellow throughout *rhamnus* sp. n.
–. Hind tibiae pale at most on about basal $\frac{1}{6}$, sometimes dark throughout; palpi with at least the basal segments darkened . . *elaboratus* Wilkinson.

Spathius elaboratus Wilkinson.

S. elaboratus Wilk., 1931, *Bull. ent. Res.* **22**: 260, ♀.

♀. Head, thorax and petiole honey-brown but the thorax sometimes quite dark brown and sometimes the mesonotum infuscated with the rest of the thorax evenly reddish; basal half of tergite (2 + 3) honey-brown but almost yellowish at base; rest of the gaster blackish or dark brown; there is considerable variation in the extent of the pale part of tergite (2 + 3) and in some dark forms, the greater part of its dorsal surface is conspicuously yellowish. Palpi darkened basally but at least the 2 apical segments of the maxillary palpi clear whitish-yellow. Hind coxae and hind femora honey-brown; hind tibiae honey-brown, but more or less colourless at base; segment 1 of the hind tarsus yellowish on basal half.

Head rather strongly transverse, as wide behind the eyes as across them, rarely very slightly narrower, about 21 : 22. Face with much broken transverse striation, almost transversely rugulose. Frons and vertex smoothly striate. Head behind the eyes smooth. Ocelli arranged in a triangle with base much longer than sides. Antenna with about 40 segments; flagellum 1 as long as scape plus pedicel.

Thorax: Pronotal keel very feeble, widely fused with the posterior margin of the pronotum; lateral area rather sharply defined, for the most part smooth and shining. Mesonotum falling vertically to the pronotum; lobes shining, more or less scaly-reticulate; notaulices well defined; posterior carinae on the whole unbroken, virtually straight, their lateral branches sometimes strong, sometimes weak; sometimes the carinae are connected by strong, transverse rugae. Scutellum feebly convex, margined laterally, scaly-reticulate, its anterior depression strongly costate. Propodeum: basal carina variable in length, varying from almost wanting to about $\frac{2}{3}$ the length of its forks; areola usually well defined;

dorsal areas with at least a large basal area of scaly-reticulation. Disc of the mesopleura shining but by no means extensively smooth, often there is an extremely faint scaly-reticulation everywhere. Wings (fig. 226). Hind coxa somewhat spherical in appearance, evenly rounded beneath at base; hairs of the upper surface of the hind tibia as long as the middle width of the tibia; apical lobe with a complete row of seven spines; hind tarsus 1 twice 2; 3 slightly shorter than 5.

Abdomen (fig. 224): Petiole broad, short, 1½ times as long as the propodeum and, seen from the side, strongly elbowed in basal ⅓; striate-reticulate, becoming smoothly striate at the apical dilatation; membrane extending fully half-way between spiracle and apex. Tergite (2 + 3) transverse, its apical width about 1½ times its middle length; basal half finely but somewhat irregularly punctate-reticulate; towards apex the surface is more finely and evenly punctate-reticulate, the sculpture extending almost to apex; this tergite has a feeble margin laterally extending to slightly beyond the 2nd spiracle; following tergites similarly but more finely sculptured, the apical margin becoming progressively more broadly smooth. Epipleura of tergite (2 + 3) shining, closely, finely punctured. Ovipositor sheaths a little shorter than gaster plus petiole.

Length: 4–4·5 mm. without ovipositor.

♂. Like the female, but the petiole more slender and less strongly elbowed at base. Basal carina of the propodeum fully as long as its forks.

Length: 4–5 mm.

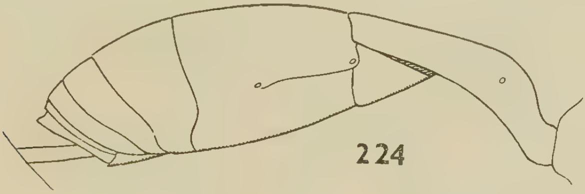


Fig. 224.—*Spathius elaboratus* Wilkinson: abdomen, lateral.

India: United Provinces, Dehra Dun, bred from wood of:—*Ficus rumphii*, *Ficus bengalensis*, *Ficus religiosa*, *Ficus clavata*, *Bombax malabaricum*, *Lannea grandis* and *Vitis latifolia*. Madras, "ex *Grewia* sp.", 21 ♂♂, 21 ♀♀, smaller than typical *elaboratus* and more or less pale brownish-yellow all over.

Hosts: *Spathius elaboratus* has been bred in association with *Osphilia odinae* Mshl. and *O. vitis* Mshl. (Curculionidae); *Diamerus curvifer* Walk., *Diamerus* sp. n. and *Cryphalus* sp. n. (Scolytidae) and with other species of bark-borers (Beeson and Chatterjee, 1935). According to Beeson and Chatterjee (1935) there are two generations of the parasite a year.

Type in British Museum (Natural History).

With some doubt I also refer to *elaboratus* a single female from the Solomon Is., Guadalcanal (*R. A. Lever*); except that the ovipositor sheaths are shorter—only about half as long as the whole abdomen—it resembles the nominotypical form very closely; colour uniformly fulvous red; only the basal segments of the maxillary palpi darkened; hind tibiae faintly brownish and pale at extreme base as in typical *elaboratus*; disc of the mesopleura almost smooth in the middle. On account of its short ovipositor this female may represent a subspecies of *elaboratus*, but no decision can be reached, I think, until more specimens have been examined. It is interesting to note that the resemblance of this specimen to typical *elaboratus* is closer than to its subspecies *verbeeki*; the reverse might have been expected.

Spathius elaboratus Wilk. subsp. **verbeeki** subsp. n.

♀. Only the apical segment of the maxillary palpi entirely pale, the penultimate segment a little infuscated towards base. Hind tibiae black virtually throughout; at base above there is a faint, quite inconspicuous, pale streak; the hind tibiae contrast sharply in colour with the yellowish-brown hind femora. Gaster duller, entirely and evenly pale yellowish-brown, its sculpture more even and at least on tergites (2 + 3) and 4 extending more or less to apex of segment. Disc of the mesopleura distinctly scaly-reticulate all over.

JAVA: Piarään, 15 ♀♀ (*Coll. Verbeek*).

Type in British Museum.

Spathius trophonius sp. n.

♀. Head dusky red-brown, the face darker; thorax virtually black; gaster very dark brown, but the basal half of tergite (2 + 3) very slightly reddish. Antennae obscurely yellowish towards base. Palpi pale yellow. Fore-wing slightly darkened; basal third of stigma yellowish. All the femora brown; basal third of the hind tibiae yellowish-white; basal segment of the hind tarsus pale on basal half. Lower half of the mesopleura chestnut-red.

Head as wide behind the eyes as across them. Face shining, reticulate-rugose; medially the rugosities arrange themselves to form on oblong patch of transverse striate sculpture. Tentorial pits deeply sunken, lying at lower end of a deep cleft which delimits the clypeus on each side. Frons and vertex with strong smooth striation. Base of the ocellar triangle clearly longer than its sides. Antennae with at least 47 segments; flagellum 1 longer than scape plus pedicel, about 19 : 14. Head behind the eyes almost smooth.

Thorax: Pronotal keel fused medially with the posterior margin of the pronotum; lateral area well defined. Mesonotum falling more or less vertically to the pronotum; seen from above, wide and somewhat truncate in front; lobes in far greater part finely sculptured, the sculpture consisting of minute, transverse ripples; no trace of posterior carinae, the large sunken area being covered very characteristically with strong more or less longitudinal wrinkles (fig. 200); mesonotal hairs rather numerous. Dorsal areas of the propodeum finely rugose, more or less scaly-reticulate medially; areola with thin pubescence. Mesopleural disc immediately above the furrow virtually smooth and unsculptured. Hind coxa roundly angled beneath at base; hairs of the upper surface of the hind tibia a little longer than the middle width of the tibia; apical lobe with 10 spines; hind tarsus 1 only about 1½ times as long as 2, 11 : 7; 3 very slightly shorter than 5, 17 : 18.

Abdomen: Petiole striate-reticulate right up to apex, except laterally at apex, where the reticulate element is absent. Tergite (2 + 3) dull, with an even, extremely fine, punctate-reticulate sculpture all over, giving almost a beaded effect, feebly margined laterally to about 2nd spiracle; broad apical margin smooth, providing an abrupt contrast with the sculptured part of the segment; tergites 4–6 with a sculpture similar to that of (2 + 3) but weaker and less definite. Ovipositor sheaths a little shorter than gaster plus petiole.

Length: 5·6 mm. without ovipositor.

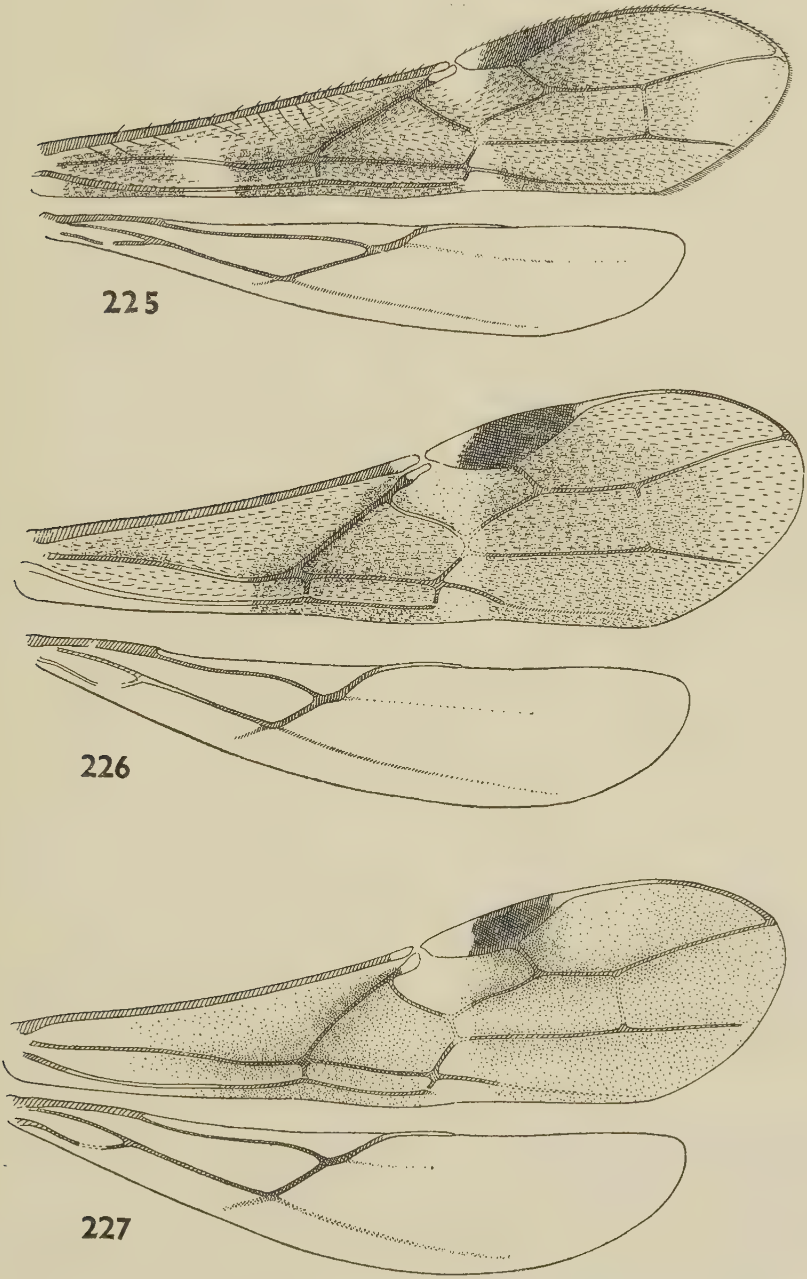
BORNEO: Sandakan, 2 ♀♀, one the type (*Baker*).

Type in U.S. National Museum.

This is a very distinctive-looking species, readily characterised by the deep clefts to the sides of the clypeus and the sculpture of the mesonotum; by these two features it differs at once from the other species I have included in the group.

Spathius rhamnus sp. n.

♀. Brown. Tergite (2 + 3) frequently darker than the rest of the body but usually paler at the basal corners. Pale yellow are :—palpi, front and middle coxae, base of the



FIGS. 225–227.—Wings of *Spathius* :—225. *Spathius apicalis* Westwood ; 226. *S. elaboratus* Wilkinson ; 227. *S. vulnificus* Wilkinson.

hind coxae and basal $\frac{2}{5}$ of the hind tibiae; front and middle tibiae not paler, or hardly so, at apex than elsewhere. Antennae yellowish in basal half, becoming evenly brown towards apex; the paler segments are faintly ringed with brown at apex.

Head not wider behind the eyes than across them. Face transversely striate, the ridges on the whole fairly even. Frons with fine, mostly transverse striation. Vertex with fine close striation which reaches the eye-margin and extends on to the temples; on the whole, the striation is very faint behind the eyes and is here most in evidence close to the occipital margin. Base of the ocellar triangle clearly a little longer than its sides. Antenna with 35–37 segments (2 ♀♀).

Thorax: Pronotal keel feeble, fused medially with the posterior margin of the pronotum. Mesonotum falling almost perpendicularly to the pronotum, feebly glistening and with a slightly roughened appearance; the anterior lobe has a distinct transverse element in its sculpture; notaulices showing as deep furrows which converge on to a much rugose area, the rugosities of which are not conspicuous owing to the pale colour of the sclerite. Scutellum evenly but not strongly convex, scaly-reticulate. Propodeum: basal carina, costulae and areola hardly defined; the surface between the raised sculpture tends to be smooth and shining: this is perhaps slightly more noticeable in the specimens from Basilan than in those from Zamboanga; the surface of the propodeum is everywhere sculptured. Mesopleura sculptured all over, the sculpture consisting mostly of fine striation which crosses the furrow and then curves backwards towards the posterior margin of the mesopleura. Legs: hind coxa with the merest trace of a basal projection; hairs of the upper surface of the hind tibia as long as its middle width; apical lobe with a complete row of spines; hind tarsus 1 twice as long as 2. Submedian cell of the fore-wing narrowed towards apex but not constricted, like that of *elaboratus* (cf. fig. 226); nervus parallelus not quite interstitial.

Abdomen: Petiole about $1\frac{1}{2}$ times as long as the propodeum, with very distinct striation —more especially on apical third—on a rugulose surface. Tergite (2 + 3) dull, extremely finely, closely punctate-reticulate, the surface giving a beaded effect; this sculpture is stronger on a basal area and weakens towards apex, leaving a smooth apical margin. Following tergites with a similar but much less determinate sculpture. Ovipositor sheaths as long as the gaster. Epipleura of tergite (2 + 3) very shining and with microscopic punctation.

Length: 3–3·5 mm. without ovipositor.

PHILIPPINES: I. of Basilan, 3 ♀♀, one the type (*Baker*). Mindanao, Zamboanga, 3 ♀♀ (*Baker*). BORNEO: Sandakan, 1 ♀ (*Baker*).

Type in U.S. National Museum.

The female from Sandakan has the sculpture of the mesopleura weaker than in the other specimens; the striation is largely obsolescent and there is vague scaly-reticulation in evidence.

Spathius chrysippus sp. n.

♀. Head fulvous yellow; thorax, except metapleura and propodeum which are fairly deeply suffused with blackish, much the same colour as the head but redder in tint; petiole blackish; tergite (2 + 3) brownish, its apical margin and the following tergites becoming obscure brownish-yellow; ventral surface of the gaster of a similar yellowish tint. Palpi entirely pale whitish-yellow. Except that the hind femora are a little darkened on each side towards apex, the legs are entirely yellow. Fore-wing faintly darkened beneath the stigma, which is pale on about basal third.

Head a little narrower behind the eyes than across them in the type, but hardly narrower in the smaller female. Face transversely rugose-striate, the sculpture weakening along the middle line. Frons and vertex finely smoothly striate. Antenna broken; flagellum 1 as long as scape plus pedicel; hairs of at least the 4 basal segments fine, inconspicuous, shorter than the width of the segments. Ocelli small, the base of the ocellar triangle clearly longer than its sides.

Thorax: Pronotal keel well developed, medially more or less contiguous with the posterior margin of the pronotum; lateral area well defined, transversely ribbed. Mesonotum falling almost perpendicularly to the pronotum in the type but considerably less steeply in the smaller female; lobes somewhat shining, with a very even scaly-reticulation all over; posterior carinae well defined; hairs sparse, outstanding. Scutellum more or less flat, closely scaly-reticulate, its anterior depression crossed by 3–5 costae. Propodeum: basal carina $\frac{2}{3}$ as long as its forks; dorsal areas with fine scaly-reticulation over anterior half in type, but over a larger area in the smaller female. Mesopleural furrow extending only a little beyond middle and with only a trace of transverse rugosity; disc finely scaly-reticulate. Hind coxa with a well-defined projection beneath; hind femur somewhat stout; hairs of the upper surface of the hind tibia about $1\frac{1}{4}$ times its middle width; apical lobe with 4 spines; hind tarsus 1 a trifle less than twice 2, 11 : 6; 3 is $\frac{3}{4}$ of 5. Medius of the fore-wing almost straight.

Abdomen: Petiole short and broad, striate-rugose. Gaster about $1\frac{1}{2}$ times as long as wide. Tergite (2 + 3) transverse, dull, with a feebly differentiated lateral margin extending to about as far as the 2nd spiracle; a basal area, probably corresponding to tergite 2, is evenly and very finely punctate-reticulate, appearing almost shagreened; apical to this area, the surface is similarly sculptured but still more finely; the two degrees of sculpture are sharply marked off from each other; tergite 4 with traces of sculpture at base; following tergites, at least that part which is exposed, smooth. Ovipositor sheaths as long as the gaster.

Length: 3·5–4·5 mm. without ovipositor.

BORNEO: Sandakan, 2 ♀♀, one the type (*Baker*).

Type in U.S. National Museum.

This species differs from *rhamnus* in the sculpture of the mesopleura, *inter alia*.

Group of **arcesius** sp. n.

Characters:—Palpi whitish-yellow. Front and middle coxae and basal trochanter of all legs whitish-yellow; hind coxae and hind femora unicolorous, dark brown.

Head not or only a little narrower behind the eyes than across them. Vertex striated or smooth. Hairs of the mesonotum sparse, outstanding. Propodeum somewhat elongate; basal carina either undefined or if defined then distinctly longer than its forks. Hind coxa evenly rounded beneath at base; hairs of the upper surface of the hind tibia about as long as its middle width; apical lobe with 3–7 spines; hind tarsus 1 twice 2; 3 fully $\frac{3}{4}$ of 5. Wings (fig. 228): medius deeply sinuate. Petiole fully twice as long as the propodeum, slender. Gaster virtually unsculptured, strongly shining but not highly polished, the surface having an extremely faint opaqueness.

AUSTRALIA. NEW GUINEA. Two species.

In spite of the virtual absence of sculpture on the gaster, I am inclined to think that this group is fairly closely related to the *apicalis*-complex of the *ruficeps*-group; the points of resemblance are:—general coloration, shape of head, short pubescence of flagellum; shape of thorax, especially of propodeum and the sculptural details of the latter; simple hind coxae. In colour the similarity lies in the possession of whitish-yellow front and middle coxae, dark hind coxae, pale post-tegulae and darkened wings.

The essential points of difference between the two groups are the absence of raised sculpture on the gaster and the much deeper sinuation of the medius of the fore-wing of the *arcesius*-group.

The two species may be separated as follows :—

Vertex striate ; apical trochanter of the hind leg brownish . . *arcesius* sp. n.
Vertex unsculptured ; apical trochanter of the hind leg in greater part whitish-yellow . . . . *kurandaensis* sp. n.

Spathius arcesius sp. n.

♀. Very dark brown to the naked eye ; head considerably paler than the thorax, somewhat yellowish around the antennal insertions ; propleura, pronotum, and upper part of mesopleura, paler than other parts of thorax. Apical trochanter of the hind legs brownish ; hind tibiae brown with a whitish-yellow post-basal band and very faintly paler at extreme apex ; hind tarsi yellowish-brown. Flagellum pale on basal 2–3 segments ; otherwise dark brown.

Head as wide behind the eyes as across them. Face rather finely transversely rugose. Frons and vertex smoothly, closely striate, the striation of the vertex fading out on the temples. Antenna broken ; flagellum 1 considerably longer than scape plus pedicel, 16 : 11 ; hairs of the more basal segments short and close, not longer than the width of the segments. Ocelli in a triangle with base a little longer than sides.

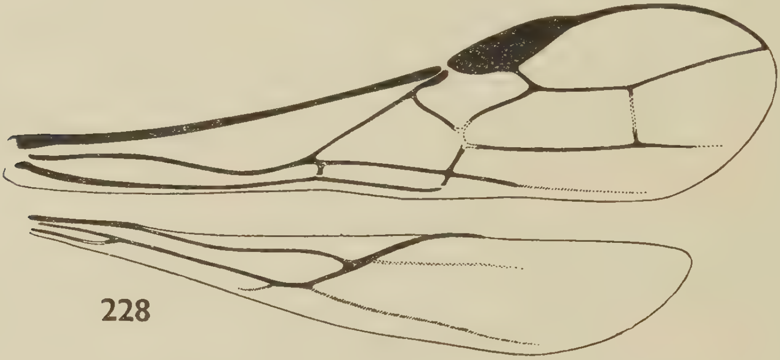


FIG. 228.—*Spathius arcesius* sp. n. : wings.

Thorax : Pronotal keel moderately well developed, clearly separated from the posterior margin of the pronotum ; lateral area moderately well defined, smooth and with transverse ribs. Mesonotum sloping rather gradually to the pronotum, its hairs long and very sparse ; lobes glistening, finely rugulose, almost shagreened (broken scaly-reticulation) ; posterior carinae clearly defined, somewhat wrinkly ; notaulices deep, their feeble costae not extending beyond the limits of the furrows themselves. Scutellum almost flat, dull, scaly-reticulate. Propodeum : basal carina rather feeble, about 1⅓ times as long as its ill-defined forks ; dorsal areas not sharply defined posteriorly, longer than wide, covered sparingly with rather weak carinulae which almost fade out anteriorly, giving way to a finely rugulose surface sculpture. Metapleura shining and almost smooth on about anterior half. Disc of the mesopleura shining but not quite smooth, there being traces of obsolescent striation spreading upwards from the wide mesopleural furrow ; apical lobe of the hind tibia with a row of 7 spines ; hind tarsus without outstanding hairs, except for those around the apical rim of the segments ; hind tarsus 3 almost as long as 5, 8 : 9. Wings (fig. 228).

Abdomen : Petiole slender, nearly 2½ times as long as the propodeum (fig. 223), rugose, the longitudinal elements decidedly feeble but stronger at sides of the apical dilatation ; in about middle ⅓ of petiole, the rugosity is decidedly transverse. Gaster with the merest trace of sculpture at base (hardly visible at × 60), otherwise shining but not highly polished. Ovipositor sheaths about as long as abdomen plus propodeum.

Length : 4·5 mm. without ovipositor.

New Guinea: Papua, Kokoda, 1200 ft., viii.1933, 1 ♀ (*L. E. Cheesman*). Type in British Museum (Natural History).

Spathius kurandaensis sp. n.

Very closely allied to *arcesius*, from which it differs as follows:—

♀. Antennae more extensively pale towards base. Thorax slightly more uniformly dark brown. Apical trochanter of the hind leg brown only on about apical third, otherwise whitish-yellow like the basal trochanter; hind tibiae more extensively pale at base, the extreme base hardly darkened; front femora extensively whitish-yellow on inner and outer side of apical half; hind tarsal segments 1–3 with a faintly yellowish apical area; dorsal surface of these segments otherwise faintly infuscated.

Head from above distinctly a little narrower behind the eyes than across them and more narrowed towards the occiput. Face with transverse rugosity much reduced; surface towards the antennal insertions feebly striate-punctate but on lower part of face merely punctate, the punctures very ill defined. Vertex smooth and shining. Flagellum 1 hardly longer than scape plus pedicel, 12 : 11.

Pronotal keel less well developed, medially more or less contiguous with the posterior margin of the pronotum; lateral area a little less well defined. Mesonotum sloping a little less gradually to the pronotum; outer edge of the notaulices on posterior half of mesonotum subcarinate (this condition is faintly indicated in *arcesius*); posterior carinae less clearly defined. Scutellum very shining, almost smooth. Basal carina of the propodeum obscured by reticulation, its forks completely undefined; on each side of propodeum at base is an oblong, very shining area which is almost smooth. Disc of the mesopleura more extensively smooth and shining. Apical lobe of the hind tibia with 3 spines; hind tarsus with outstanding hairs but they are short and inclined at an angle of about 30 degrees.

Petiole twice as long as the propodeum.

Australia: N. Queensland, Kuranda, 1100 ft., v–vi.1913, 1 ♀, the type (*R. E. Turner*).

Type in British Museum (Natural History).

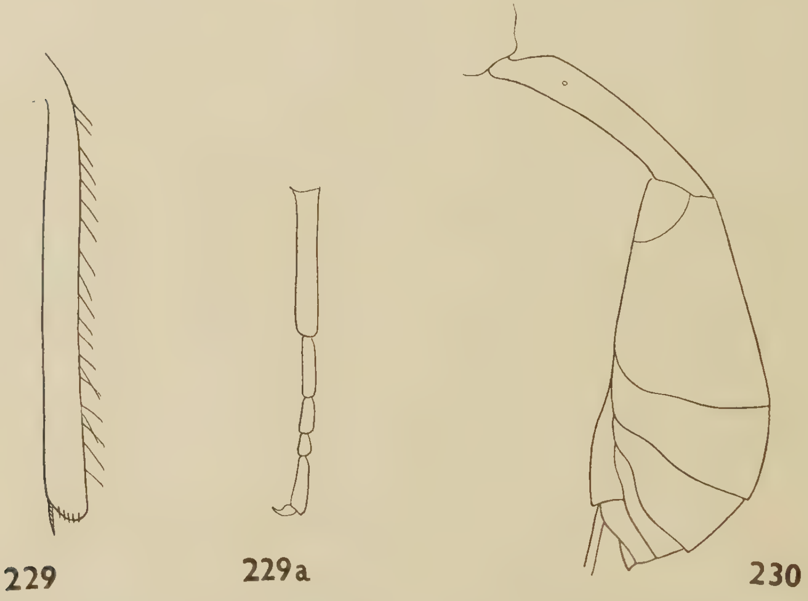
Group of **nyctimene** sp. n.

Spathius nyctimene sp. n.

♀. Very dark brown but the gaster a little paler than the petiole. All the trochanters and the middle coxae honey-yellow; hind coxae and hind femora dark brown; hind tibiae paler brown than their femora, whitish on rather less than basal $\frac{1}{4}$. Palpi honey-yellow. Antennae brownish, yellowish towards base. Wings strongly infumated, with an ill-defined hyaline fascia cutting base of stigma. Post-tegulae honey-yellow.

Head as wide behind the eyes as across them. Face coarsely and closely rugose-reticulate, the sculpture weakening a little medially but nowhere with transverse elements. Frons irregularly rugose everywhere. Vertex striate-rugose, the carination decidedly subconfluent and tending to fade out on posterior declivous part of the vertex. Eyes rather small, their longer axis $1\frac{1}{3}$ times as long as the malar space. Antenna broken; flagellum 1 a little shorter than scape plus pedicel, 4 : 5; flagellar hairs pale, somewhat bristly, about half the width of the segments. Base of the ocellar triangle clearly longer than its sides.

Thorax: Pronotal keel very weakly developed, medially widely fused with the posterior margin of the pronotum; lateral area not delimited. Mesonotum rather strongly gibbose in front, falling more or less perpendicularly to the pronotum; sculpture of lobes everywhere consisting of irregular scaly-reticulation; notaulices closely costate, converging on to a deeply sunken area, which contains 2–3 longitudinal wrinkly carinae and irregular reticulate-rugosities; posterior carinae not developed as such in the unique female; hairs rather short, but outstanding, sparse and not readily visible when the mesonotum is seen from above. Scutellum feebly convex, shining, feebly sculptured. Propodeum without distinct areation; basal carina wanting, the middle line covered with irregular reticulations; an areola is just indicated by very irregular carinae (it is possible that individuals might occur which would show an areola of much clearer outline); irregular reticulations cover all that part usually delimited as the dorsal areas but they become much finer towards base. Mesopleural furrow deep, strongly costate throughout, reaching almost to middle coxa; disc polished, more or less smooth. Legs: hind coxa roundly angled at base; hairs of the upper surface of the hind tibia a little more than semi-erect, as long as its middle width (fig. 229); apical lobe with 5 fine spines; hind tarsus 1, $2\frac{1}{2}$ times as long as 2; 3 a trifle more than half 5, 6 : 11 (fig. 229a). Recurrens received into the 2nd cubital cell at a distance from the 1st intercubitus equal to rather more than half its own length; radius leaving stigma considerably beyond middle; submedian cell not constricted; nervus parallelus not quite interstitial.



FIGS. 229–230.—*Spathius nyctimene* sp. n., ♀; 229. hind tibia; 229a. hind tarsus; 230. abdomen, lateral.

Abdomen: Petiole more or less parallel-sided apart from the apical dilatation; rather narrow, a little less than twice as long as the propodeum, rugose with a few carinae, more especially towards apex. Gaster (fig. 230); tergite (2 + 3) with excessively fine patchy aciculation which tends to be concentric around the mid-basal point; the apical $\frac{1}{4}$ of (2 + 3) and the whole of the following tergites are completely smooth; t. (2 + 3) shows a trace of a margin extending about $\frac{1}{3}$ the distance between the 2 spiracles. Ovipositor sheaths about as long as the whole body.

Length: about 5·8 mm. without ovipositor.

MADAGASCAR: 1 ♀ (*J. de Gaulle*, 1919).

Type in British Museum (Natural History).

This seems to be an isolated species and I am not prepared to say what its allies might be. In general facies there is nothing particularly striking about it.

The sculpture of tergite (2 + 3) is likely to be specific; on the other hand, the short 2nd and 3rd segments of the hind tarsus are probably characteristic of a group of species.

Only three species of *Spathius* are known to me to occur in Madagascar; all of them, so far as it is possible to judge, are endemic. The two other species are *S. berlandi* sp. n., and *S. merope* sp. n.

Group of **vesevus** sp. n.

Characters: Blackish species to the naked eye. Vertex closely striate. Pronotal keel more or less undeveloped; lateral area of the pronotum completely undefined. Mesonotum strongly gibbose in front, falling almost perpendicularly to the pronotum, clothed at least on middle lobe and anterior part of lateral lobes with dense adpressed pubescence with which longer hairs may be mixed. Nervus parallelus of the fore-wing exactly interstitial. Hind coxa without a projection beneath at base. Tergite (2 + 3) with fine aciculation which may vary in direction.

PHILIPPINES. Two species.

The group is largely characterised by the fine pubescence of the mesonotum, the absence of a defined lateral area to the pronotum and the aciculation of tergite (2 + 3). It is probably fairly closely related to the group of *elaboratus* on account of the suppression of the pronotal keel and the abrupt anterior declivity of the mesonotum.

The two species may be separated as follows:—

Head bright brownish-red contrasting with the blackish thorax; segment 3 of the hind tarsus only a little more than half 5 . . . . *vesevus* sp. n.
Head dark brown, hardly paler than the thorax; segment 3 of the hind tarsus a trifle longer than 5 . . . . *silius* sp. n.

Spathius vesevus sp. n.

♀. Black; the head contrasting bright brownish-red; rather more than the basal half of tergite (2 + 3) suffused with brown. Post-tegulae brown. Basal flagellar segments dark. Palpi dirty yellow. Front and middle femora very dark brown; hind tibiae dark brown throughout; basal segment of the hind tarsus yellowish but becoming infuscated on about apical $\frac{1}{3}$. Wings brownish, the stigma pale on about basal $\frac{1}{4}$.

Head transverse, very slightly wider behind the eyes than across them, 45 : 43. Face closely rugose-reticulate, with only very feeble transverse elements, though these become more apparent towards the cheeks. Frons and vertex smoothly striate; the striation fades out on the posterior declivous part of the vertex and is absent on the temples. Antenna broken; flagellum 1 only a trifle longer than scape plus pedicel, 15 : 14; hairs of at least the more basal segments extremely short and inconspicuous. Ocelli in a triangle with base a little longer than sides; width across the posterior ocelli equal to the distance between one of them and the eye-margin.

Thorax: Pronotum densely clothed with silvery-grey pubescence all over; keel undeveloped; lateral area completely undefined. Mesonotum strongly gibbose in front, with prominent rounded "shoulders", falling almost perpendicularly to the pronotum, clothed densely all over with short silvery-grey pubescence; lateral lobes on their horizontal surface having a decidedly flattened appearance, the notaulices here not being sunken; the surface of this flattened part has a ground sculpture of scaly-reticulation and further, is covered with rather large, ill-defined puncture-like impressions which, within the notaulic courses, give way to short transverse rugae; posterior carinae thick and strong, extending almost to within a third of the anterior margin; middle lobe covered with somewhat rough scaly-reticulation. Scutellum almost flat, with an indefinite sculpture; its anterior depression with 3 strong close costae. Postscutellum thickly pubescent medially. Propodeum: basal carina a little longer than its forks; areola very poorly defined; dorsal areas covered with strong transverse rugose-reticulations which fade out anteriorly. Mesopleura hairy all over; within the subalar impression the pubescence forms a dense silvery pile, quite conspicuous to the naked eye; disc covered with irregular subobsolescent rugosities. Hind coxa without a projection at base; hind femur somewhat stout; hairs of the upper surface of the hind tibia about $1\frac{1}{3}$ times as long as its middle width; apical lobe without spines; hind tarsus short, segment 1 a little more than twice 2, 9 : 4; 3 only a trifle more than half 5, 7 : 12. Recurrens almost, nervus parallelus, exactly interstitial.

Abdomen: Petiole twice as long as the propodeum, appearing rather long and narrow, decidedly narrowed in apical half, its sculpture on about basal $\frac{2}{3}$ almost smoothed out. Gaster rather strongly narrowed at base, tergite (2 + 3) being twice as wide apically as basally; this segment finely smoothly longitudinally aciculated on at least basal half; just apical to middle, the aciculation diverges towards each apical corner; the broad apical margin is transversely aciculated; following tergites with excessively fine aciculation along apical margin; elsewhere the tergites appear to show merely an excessively fine roughening of the surface; tergite (2 + 3) shows laterally a distinct creaselike margin extending from base to apex; its epipleura are shining, membranous and show traces of microscopic punctation. Ovipositor sheaths as long as the abdomen plus propodeum.

Length: 6 mm. without ovipositor.

PHILIPPINES: I. of Samar, 1 ♀ (*Baker*).

Type in U.S. National Museum.

This is a very distinct species and need not be confused with any other dealt with in this monograph. It is amply distinct from the following species on the characters given in the key.

Spathius silius sp. n.

Differs from *vesevus* as follows:—

♀. Head very dark brown; to the naked eye appearing almost as dark as the thorax; gaster on the whole with a slightly more pronounced reddish tint; tergite (2 + 3) not pale at base. Basal flagellar segments pale, yellowish like the scape and pedicel. Palpi brownish. Post-tegulae whitish. Hind tarsi evenly brownish throughout but not so dark as their tibiae. Stigma pale on less than basal $\frac{1}{4}$.

Face with closer rugose-reticulation, almost coarsely rugose; transverse element still less in evidence. Striation of the vertex sharper and much closer; it covers the temples everywhere and extends, though losing its regular appearance and becoming subconfluent, all over the postgenae to the base of the mandibles. Antenna with 48 segments; flagellum 1 a trifle longer than scape plus pedicel, 17 : 15. Base of the ocellar triangle less obviously longer than its sides.

Short adpressed pubescence of the mesonotum is restricted to the middle lobe and anterior part of the lateral lobes; the middle and posterior part of the lateral lobes are free from any hairs; long outstanding hairs occur, mixed with the short pubescence; they are longest and most in evidence within and bordering the courses of the notaulices; lateral lobes not flattened and with hardly a trace of puncture-like impressions; posterior ridges shorter, less emphasised. Scutellum duller, evenly scaly-reticulate, its anterior depression a little deeper. Basal carina of the propodeum very much broken, not longer than its forks. Silvery-grey pile of the subalar impression of the mesopleura thinner, hardly noticeable to the naked eye; disc with more scaly-reticulation in evidence, especially on posterior half. Apical lobe of the hind tibia with a complete row of spines; hind tarsus more slender, segment 1 being a little less than twice 2, 38 : 21; 3 a trifle longer than 5, 7 : 6. Recurrens less nearly interstitial.

Petiole not constricted in apical half, its sculpture stronger, the longitudinal element well marked. Gaster not strongly narrowed at base, being two-thirds as wide basally as apically; on basal half of tergite (2 + 3) the aciculation is rather broken and is more or less concentric about the mid-basal point; laterally it is more or less longitudinal and towards apex of segment it becomes transverse; lateral margin of tergite (2 + 3) fading out midway between 1st and 2nd spiracle; no differentiation between the dorsal surface of tergite (2 + 3) and its epipleura, aciculation being present on the latter, though less definite. Ovipositor sheaths shorter, as long as the abdomen.

Length: 6·75 mm. without ovipositor.

PHILIPPINES: Palawan, Puerto Princesa, 1 ♀ (*Baker*).

Type in U.S. National Museum.

The differences between this species and *vesevus* are numerous and certainly suggest that the relationship is not a close one. The most significant points of dissimilarity are, in my opinion, presence of spines on apical lobe of hind tibia and long 3rd segment of the hind tarsus of *silius*.

Group of *piperis* Wilkinson.

Spathius piperis Wilkinson.

Spathius piperis Wilk., 1931, *Bull. ent. Res.* **22** : 264, ♂♀.

♂♀. Almost cinnamon brown, the head and thorax being entirely of this colour and nowhere showing infuscation; petiole sometimes a little deeper in tint than the thorax; basal $\frac{2}{3}$ of tergite (2 + 3), a broad basal band on tergites 4 and 5, brown; the gaster otherwise decidedly yellowish. Palpi yellowish throughout. Front and middle coxae honey-yellow; hind coxae brownish-yellow; hind femora uniformly yellowish-brown; hind tibiae brownish-yellow, faintly darkened at middle and faintly paler at base.

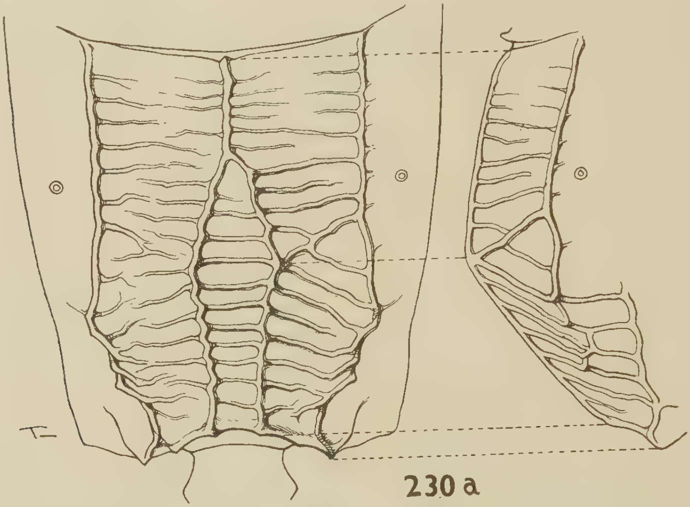
Head markedly narrower behind the eyes than across them. Face with decidedly strong broken striation, which is hardly weaker along the middle line. Frons and vertex striate, but not smoothly so, the ridges being a little wrinkled and the intervals rugulose. Head behind the eyes sculptured all over. Antenna with 32–37 segments; flagellum 1 as long as scape plus pedicel. Ocelli small, almost in an equilateral triangle.

Thorax: Pronotal keel narrowly fused or contiguous with the posterior margin of the pronotum; lateral area moderately well defined, delimited along lower margin by a strong keel. Mesonotum sloping rather gradually to the pronotum, dull and with much raised rugosity; on middle lobe are feeble broken transverse wrinkles and on lateral lobes only a narrow linear band of fine surface sculpture is left free; posterior carinae strong but sometimes very much broken; the raised rugosities of the mesonotum, especially the thickened ones of the lateral lobes, covered with the prevailing scaly-reticulate surface sculpture; hairs very sparse. Scutellum more or less flat, dull, scaly-reticulate, its anterior depression with 3–4 keels. Propodeum: basal carina about as long as its forks; areola narrow, well defined, confluent with the narrow area petiolaris (fig. 230a); the area thus formed evenly transversely ridged; generally no clearly emphasised costulae, so that the dorsal areas are not delimited behind; they themselves are covered with fine transverse rugosity on a scaly-reticulate ground sculpture almost all over. Mesopleura sculptured almost all over; medially on disc is a small area with only scaly-reticulation, but elsewhere are strong rugae, irregular in direction. Hind coxa bluntly angled at base; hind femur rather thick; hind tibia also rather thick, a little swollen basally, the hairs of its upper surface not very numerous, the longest of them only a litle longer than its middle width, about 6 : 5; apical lobe with 5–6 inconspicuous spines; hind tarsus 1 not quite twice 2, 17 : 9; 3 is $\frac{2}{3}$ of 5. Medius of the fore-wing strongly curved but the submedian cell only very slightly constricted beyond middle.

Abdomen: Petiole in profile strongly swollen and strongly elbowed at spiracles, about 1½ times as long as the propodeum, striate-rugose, markedly constricted beyond spiracles. Gaster rather narrowly fusiform, twice as long as its greatest width; tergites (2 + 3) and 4 (5 less distinctly) finely longitudinally striated, the intervals faintly rugulose. Ovipositor sheaths a little shorter than the gaster. Epipleura of tergite (2 + 3) shining, almost smooth, at most a trace of obsolescent punctation present; tergite (2 + 3) seems to have no clearly differentiated lateral margin but there is a faintly well-defined line of demarcation between its dorsal and ventral surface.

Length: 4–5·5 mm. without ovipositor.

♂. Like the female but tergites (2 + 3)–5 with a completely differentiated lateral margin. Length: 3–4 mm.



230 a

FIG. 230a.—*Spathius piperis* Wilkinson, propodeum (after Wilkinson).

DUTCH EAST INDIES: Banka, Pankalpinang (type loc.), 1930 (*J. van der Vecht*).

Host: *Lophobaris piperis* Mshll., on *Piper nigrum*. Type in British Museum (Natural History).

This is a species of doubtful affinities and I can suggest no close allies. It is readily characterised by the striation of the gaster in combination with colour.

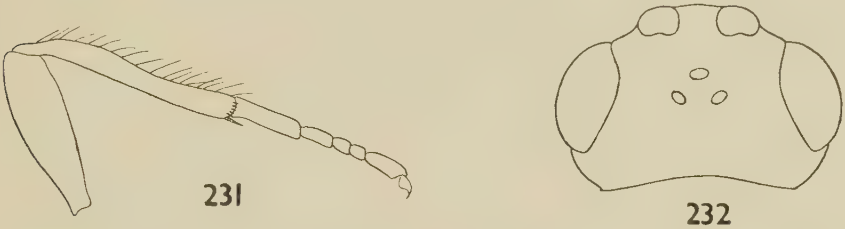
Group of **pasyphae** sp. n.

Spathius pasyphae sp. n.

♀. Head red with a faint crimson tinge. Thorax blackish, extremely faintly reddish along the imaginary course of the notaulices and in the region of the propleura; petiole black-brown, with a faint reddish tinge along the middle; gaster evenly brown. Palpi whitish-yellow. Antenna dark brown, including the scape and pedicel; flagellum becoming very slightly paler after about the 6th segment and with 4 yellow preapical segments, there being one dark apical segment. All the coxae and trochanters brownish; femora yellowish-brown but darkened along the outer side; all the tibiae dark brown on rather more than basal half, thence becoming yellowish-brown towards apex; hind tarsus yellowish-brown but the basal segment darkened above. Wings evenly and faintly brownish; stigma very pale, whitish with the faintest brownish tinge.

Head strongly transverse, clearly narrower behind the eyes than across them (fig. 232). Face shining, highly polished and with sparse punctures from which the hairs arise. Frons and vertex completely smooth. Base of the ocellar triangle considerably longer than its sides. Antenna with 36 segments; scape rather large, about twice as long as its greatest width; hairs of the flagellum shining brown, bristly, about two-thirds the width of the more basal segments; flagellum 1 considerably shorter than scape plus pedicel, 3 : 5.

Thorax short and high. Pronotum smooth, unsculptured, except for a few short rugosities along the ventral margin; keel absent; lateral area in no way delimited. Mesonotum falling virtually perpendicularly to the pronotum, completely unsculptured, smooth; hairs sparse, outstanding; notaulices wanting. Scutellum very feebly convex, its anterior depression divided into two smooth oblique foveae. Mesopleura unsculptured, except for the feebly foveate furrow. Pronotum, mesonotum, mesopleura and to a less extent the other parts of the thorax, in spite of their smoothness, lacking a highly polished appearance owing to the presence of a faint bluish lustre, which is more apparent in some lights than others. Propodeum: areolation complete, the dividing carinae strong; basal carina short, about one-quarter the length of its forks; area petiolaris sharply separated from the areola but more or less confluent with the areas on each side of it; ridge separating the dorsal surface of the propodeum from the posterior, declivous part strongly raised; dorsal areas almost smooth, except around the edges. Legs rather short and stout (fig. 231); hind coxa with a rather feeble projection; hind tibia decidedly thick, markedly swollen on basal half; hairs of the upper surface of the hind tibia, numerous, semi-erect, about one and one-third times the middle width of the tibia; lobe with 5 spines; hind tarsus short; segment 1 more than twice 2, 7 : 3; 3 hardly twice as long as wide, and hardly half as long as 5; middle tarsus also short, segment 2 being not longer than wide. Recurrens of the fore-wing received into the 2nd cubital cell at a distance from the 1st intercubitus equal to one-third its own length; nervus parallelus virtually interstitial.



FIGS. 231–232.—*Spathius pasyphae* sp. n., ♀:—231. hind leg; 232. head, dorsal.

Abdomen: Petiole about $1\frac{3}{4}$ times as long as propodeum, with obsolescent reticulate-punctate sculpture; gaster evenly oval, smooth and shining. Ovipositor sheaths as long as the whole abdomen.

Length: 4 mm. without ovipositor.

PHILIPPINES: Luzon, Mt. Makiling, 1 ♀ (*Baker*).

Type in U.S. National Museum.

A remarkable species on account of the absence of sculpture on the mesonotum in particular.

Spathius pasyphae Nixon var. **biliranensis** var. n.

The differences in appearance between this form and typical *pasyphae* are large enough, I think, to justify at least a provisional name. The variety differs as follows:—

♀. All the upper surface of the head, right down as far as the temples, blackened. Antenna with 6 yellow preapical segments and 2 dark apical ones. Tibiae more extensively pale, their pale area as well as the pale parts of the rest of the legs almost honey-yellow; upper surface of all the coxae pale. Thorax black without any bluish lustre.

Basal carina of the propodeum about ⅔ the length of its forks; dorsal areas with a few obsolescent, transverse, rugae; these propodeal differences may be purely individual.

Philippines: I. of Biliran, 1 ♀ (*Baker*).
Type in U.S. National Museum.

Group of *imbecillus* Enderlein.

Characters: Species of very slender build (fig. 235). Head distinctly narrower behind the eyes than across them. Vertex always smooth and shining, at most with indication of scattered setiferous punctures (except in *festus* sp. n.). Pronotal keel very strongly developed, widely separated from the posterior margin of the pronotum. Mesonotum with only a feeble anterior declivity. Hind coxa long, narrowly ovate, without a projection at base beneath; apical lobe of the hind tibia with at most 2–4 spines (not easy to see) close to the shorter spur. Wings (figs. 244 and 245). Petiole very long, its apical half narrower than its basal; gaster very narrow; tergite (2 + 3) much longer than its apical width, with or without sculpture. With the exception of *imbecillus*, the species are more or less uniformly pale brown with the palpi whitish-yellow.

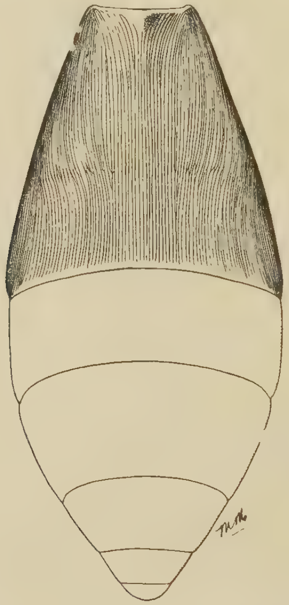


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Fig. 233.—*Spathius philodemus* sp. n., ♀: gaster, to show striation of tergite (2 + 3).

Malaya. Borneo. Philippines. Ten species.

Key to the species of the *imbecillus* group.—Females.

1. Mesonotum clothed thickly with minute adpressed hairs but often with longer ones mixed. (Spp. with the radius leaving stigma more or less at middle; recurrens virtually interstitial; tergite (2 + 3) dull, finely sculptured almost everywhere) . . . . 2.

–. Mesonotum clothed only with very long sparse hairs. (Spp. with tergite (2 + 3) smooth or almost smooth, or, if sculptured, then the sculpture consisting of fine aciculation) . . . . 4.

2. Tergite (2 + 3) about twice as long as apically wide, appearing parallel-sided. (Tergite (2 + 3) with a dark medial band and laterally margined with yellow or with two semicircular yellow patches) . . . . . . *olearus* sp. n.

–. Tergite (2 + 3) less than $1\frac{1}{2}$ times as long as apically wide, not appearing parallel-sided . . . . 3.

3. Lateral lobes of the mesonotum everywhere showing a fine even more or less granulate sculpture; dorsal areas of the propodeum clearly defined and, at least on anterior half, without raised rugosities, only a subscaly-reticulate sculpture being present . . . . . . *phalanthus* sp. n.

–. Lateral lobes of the mesonotum with raised rugosities almost everywhere; dorsal areas of the propodeum not clearly defined posteriorly, everywhere with thick smooth transverse rugosities; no ground sculpture present *pyrrhus* sp. n.

4. Segment 1 of the hind tarsus fully twice as long as 2 . . . . 5.

–. Segment 1 of the hind tarsus at most $1\frac{2}{3}$ as long as 2 . . . . 6.

5. Mesopleura highly polished, unsculptured over almost all the disc; lateral lobes of the mesonotum with only a narrow medial band of fine sculpture; vertex entirely smooth; tergite (2 + 3) entirely smooth . . *elicius* sp. n.

–. Mesopleura with some sort of sculpture over most of its disc; lateral lobes of the mesonotum with fine sculpture over most of their surface; vertex with indication of fine transverse aciculation; tergite (2 + 3) with traces of excessively fine aciculation towards base . . . . . *festus* sp. n.

6. Tergite (2 + 3) with only extremely weak longitudinal aciculation on basal $\frac{2}{3}$ 7.

–. Tergite (2 + 3) covered almost to apex with fine smooth aciculation of variable direction. . . . . 9.

7. Mesonotum very shining, in spite of its strong sculpture; this consisting of smooth predominantly transverse rugae; scutellum smooth or at any rate without an even scaly-reticulation . . . . *narses* sp. n.

–. Mesonotum not very shining, its sculpture more broken up and with a feeble to strongly characteristic overlay of fine scaly-reticulation; scutellum scaly-reticulate . . . . 8.

8. Propodeum characteristically dull, covered everywhere with a fine surface sculpture; raised sculpture not much in evidence on propodeum *tydeus* sp. n.

–. Propodeum shining, without a surface sculpture; raised rugose sculpture much in evidence on propodeum . . . . *vulturnus* sp. n.

9. Subalar impression of the mesopleura virtually smooth and unsculptured; lateral lobes of the mesonotum in greater part with a fine surface sculpture; head and thorax usually dark brown . . . . . *imbecillus* End.

–. Subalar impression of the mesopleura with strong longitudinal rugosities; lateral lobes of the mesonotum with only a narrow medial band of fine sculpture or here nearly smooth; somewhat pale brown species *vahalis* sp. n.

Spathius imbecillus Enderlein.

Stenophasmus imbecillus Enderlein, 1912, *Arch. Naturgesch.* 78 (A2) : 10, ♀.

♀. Largest individuals dark shining brown; tergite (2 + 3) showing a purplish ferrugineous tint to the naked eye; face in large dark individuals paler around the antennal insertions and along the inner orbits; smaller specimens are pale brown all over (such is the type). Legs more or less honey-brown; hind femora sometimes a little infuscated. Stigma hardly pale at base.

Head clearly a little narrower behind the eyes than across them (fig. 238). Face somewhat coarsely reticulate-rugose and with only a feeble transverse element. Frons with striation widely interrupted along the middle and laterally extending hardly beyond the line of the posterior ocelli. Antennae with 52–57 segments; flagellum 1 a little longer than scape plus pedicel, 7 : 5. Ocelli in a triangle with base considerably longer than sides.

Thorax: Pronotum about $\frac{1}{3}$ or even less the length of the mesonotum, its keel a little less well developed and placed closer to the posterior margin than in *vahalis* sp. n.; lateral area completely smooth. Notaulices not defined, at least along the middle part of their course; the medial part of the mesonotum is crossed by strong transverse carination which does not extend quite as far as the middle of the lateral lobes; towards the posterior margin of the mesonotum, some of these ridges break medially and tend to become longitudinal in direction, but no two of them are emphasised to form the two usually differentiated posterior carinae; surface sculpture of the lateral lobes not restricted to a narrow linear zone but covering a much more extensive area. Postscutellum in profile simple. Propodeum strongly and characteristically transversely carinate. Disc of the mesopleura completely smooth; subalar impression virtually without raised sculpture. Scutellum almost flat, shining and virtually smooth. Metapleura almost smooth over the greater part of its surface. Hind leg (figs. 236 and 240). Wings as in *vahalis* sp. n. (cf. fig. 245).

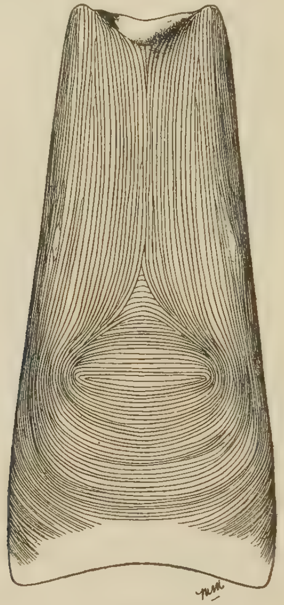

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FIG. 234.—*Spathius imbecillus* Enderlein; tergite (2 + 3).

Abdomen: Petiole fully $3\frac{1}{2}$ times as long as the propodeum. Aciculation of tergite (2 + 3) as in fig. 234; tergite 4 with indication of fine transverse aciculation in largest individuals. Ovipositor sheaths as long as the whole body.

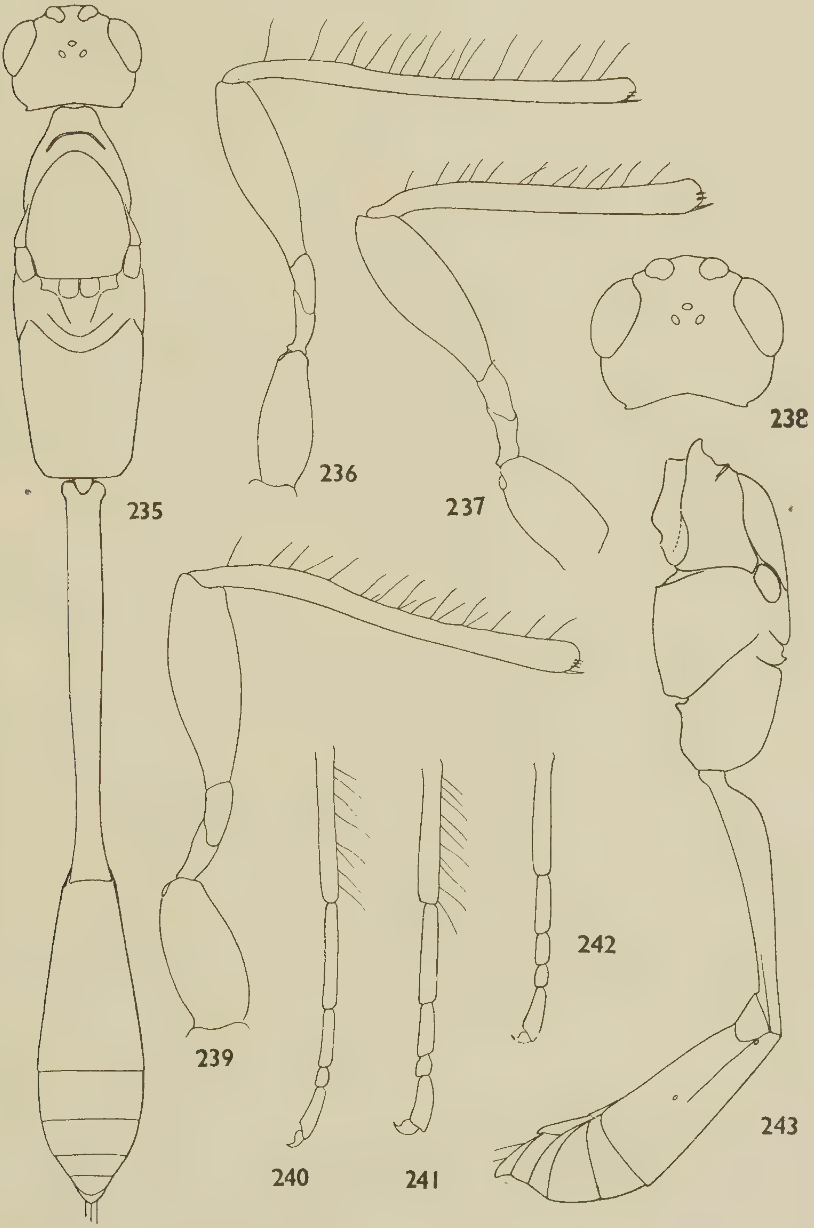
Length: 6–8 mm. without ovipositor.

MALAYA: Singapore, 4 ♀♀ (*Baker*). BORNEO: Sandakan, 3 ♀♀ (*Baker*); Siluas, Sambas, *Type* ♀ (*Micholitz*).

The type of this species, which is in the Zoological Museum, Berlin, was lent to me through the courtesy of Dr. H. Bischoff.

Spathius vahalis sp. n. (fig. 235).

♀. Appearing medium brown to the naked eye with the thorax slightly darker; head brownish-yellow; thorax brownish-red with a purplish tint; petiole and basal half of the gaster considerably darker in tint than the thorax; apex of the gaster becoming paler.



FIGS. 235–243.—235. *Spathius vahalis* sp. n.; 236. *S. imbecillus* Enderlein, hind leg, ♀; 237. *S. festus* sp. n., hind leg, ♀; 238. *S. imbecillus*, head; 239. *S. narses* sp. n., hind leg; 240. *S. imbecillus*, hind tarsus; 241. *S. narses*, hind tarsus; 242. *S. festus*, hind tarsus; 243. *S. festus*, thorax and abdomen, lateral.

Flagellum very slightly paler at apex. Legs honey-yellow to honey-brown, the hind pair sometimes approaching the colour of the thorax. Fore-wings fairly evenly tinted with pale brown; stigma yellowish only on about basal $\frac{1}{5}$.

Head considerably narrower behind the eyes than across them; the eyes prominent. Face with shining confluent striation. Frons strongly smoothly striate, the sculpture virtually reaching the eye-margin. Ocelli arranged in a triangle with base much longer than sides. Antenna with 48–51 segments (3 ♀♀); flagellum 1 slightly longer than scape plus pedicel, 11 : 9.

Thorax: Pronotum long, varying from a little more than $\frac{1}{3}$ to nearly $\frac{1}{2}$ the length of the mesonotum, its keel free, strongly developed, situated a little behind the middle; lateral area crossed by smooth, fairly widely spaced ridges. Mesonotum: notaulices crossed by strong shining rugae which extend beyond the boundaries of the furrows themselves and cover the entire surface of the lateral lobes except for a narrow longitudinal band of fine sculpture; posterior carinae not defined as such, the posterior surface of the mesonotum tending to be merely irregularly striate-reticulate; when the carinae are clearly defined they are broken and very wrinkly in appearance. Scutellum almost flat, shining and virtually smooth. Postscutellum, seen from the side, simple. Propodeum: at most a trace of a basal carina; areola absent; almost entire surface of the propodeum covered with strong shining rugae which are on the whole transverse in direction but in places flow together to form irregular reticulation. Disc of the mesopleura smooth, shining; subalar impression with a variable amount of smooth costiform rugosity; the furrow transversely costate or sometimes merely defined as a row of deep foveae. Metapleura coarsely reticulate. Wings (fig. 245). Legs clothed with long erect bristly hairs; hind coxa narrowly and evenly oval, about $\frac{2}{3}$ as long as its femur, transversely fluted towards apex above; hairs of the upper surface of the hind tibia a little more than twice its middle width; apical lobe with two inconspicuous spines near the shorter spur; hind tarsus 1 about $1\frac{1}{2}$ times as long as 2, 13 : 9, clothed with long erect hairs similar to those of its tibia; 3 a little shorter than 5, 9 : 10, or sometimes not at all shorter.

Abdomen: Petiole fully three times as long as the propodeum, narrow, more so beyond the spiracles and narrowest just before apex; except for the striated apical quarter, it is strongly shining and virtually without raised rugosities, only a feeble subscaly-reticulation being present. Tergite (2 + 3) nearly twice as long as its apical width, 40 : 23, fairly sharply margined laterally as far as the second spiracle, with a fine even aciculation which is longitudinal on basal half but in apical half is convergent and tends to be concentric about a middle point situated just beyond the very ill-defined suture; the aciculation is arranged as in *imbecillus* but is weaker (cf. fig. 234); following tergites smooth all over. Ovipositor sheaths as long as the whole body.

Length: about 8 mm. without ovipositor.

MALAYA: Singapore, 4 ♀♀, one the type (*Baker*). BORNEO: Sandakan, 2 ♀♀ (*Baker*).

Type in U.S. National Museum.

Spathius narses sp. n.

Very much like *vahalis* from which it differs as follows:—

♀. On the whole larger. Head hardly paler in tint than the brownish-red thorax. About basal $\frac{1}{3}$ of the stigma of the fore-wing deep yellowish.

Face more strongly sculptured, the transverse element hardly present. Antenna with 52–56 segments.

Lateral area of the pronotum completely smooth. Sculpture of the mesonotum slightly stronger; posterior carinae always well defined, virtually parallel. Propodeum: a more or less defined basal carina present, extending to middle or nearly to middle; areola likewise defined though sometimes very feebly; sculpture on the whole coarse, shining, sometimes consisting of ill-defined reticulation; this reticulation, especially within the areola, oftens straightens out to form transverse carination. Mesopleura with more raised rugosity; the subalar impression has strong longitudinal rugae which extend over the upper part of the disc; usually the disc shows traces of coarse obsolescent rugosities but sometimes the surface is in large part smooth. Hind coxa decidedly shorter, less narrowly ovate; hind femur more abruptly narrowed at base; hind tibia more swollen basally (figs. 239 and 241). Radius leaving stigma still farther beyond middle.

Petiole shorter in proportion to the length of the propodeum, a little less than 3 times as long. Tergite (2 + 3) with extremely feeble, often almost absent, longitudinal aciculation which extends only a little beyond the middle.

PHILIPPINES: Luzon, Mt. Makiling, 1 ♀. Mindanao, Kolambugan, 1 ♀, the type. Negros, Cuernos Mts., 1 ♀. Mt. Banahao, 1 ♀. I. of Basilan, 3 ♀♀ (*Baker*).

Type in the U.S. National Museum.

This species differs also from *imbecillus* in almost all the details which separate it, *narses*, from *vahalis*. It seems to be essentially characterised by the combination of the sculpture of the propodeum and of tergite (2 + 3).

Spathius vahalis, *imbecillus* and *narses* form a very compact species-group linked together by the shining surface (in spite of strong rugosity) of the thorax; they are closely allied to the two following species chiefly because of the long second segment of the hind tarsus.

Spathius tydeus sp. n.

Differs from *vahalis* as follows :—

♀. Antennae broken but dark for 42 segments.

Lateral area of the pronotum entirely smooth. Mesonotum dull in appearance, its raised rugosities similar in extent and arrangement but the entire mesonotal surface (including that of the rugosities themselves) overlaid with an extremely fine close scaly-reticulation. Scutellum dull, closely scaly-reticulate. Propodeum: basal carina feebly indicated; areola absent; raised rugosities weak; the entire surface dull, closely overlaid with a ground sculpture similar to that of the mesonotum. Metapleura dull, having only obsolescent raised rugosities and these apparent chiefly along the upper margin; in the smaller female (Mt. Makiling) the dull ground sculpture predominates. Mesopleura: subalar impression with strong striation which spreads over the upper part of the disc; costae of the furrow spreading upwards as obsolescent carination on to the disc; indication of scaly-reticulation everywhere. Long hairs of the hind tibia slightly shorter; hind coxa dull and covered with the predominating ground sculpture.

Petiole a little shorter, about 2½ times as long as the propodeum, dull, having the prevailing ground sculpture and except at the apical dilatation, with virtually no trace of longitudinal rugosity. Gaster a little shorter and wider; tergite (2 + 3) only about 1½ times as long as apically wide, with extremely faint broken aciculation which extends over about basal two-thirds.

Length: 5·3–8 mm. without ovipositor.

PHILIPPINES: Mt. Banahao, 1 ♀, the type (*Baker*). Luzon, Mt. Makiling, 1 ♀ (*Baker*). I. of Polillo, 1 ♀ (*Böttcher*).

Type in U.S. National Museum.

Spathius vulturnus sp. n.

Differs from *vahalis* as follows :—

♀. Distal 8 segments of the flagellum clear yellow.

Lateral area of the pronotum entirely smooth. Mesonotum as for *tydeus* sp. n. Propodeum less shining, owing to faint indication of scaly-reticulation, its raised rugosities numerous but not strong and forming vague reticulation in which there is no marked transverse tendency as in *vahalis*. Mesopleura with shining raised rugosities of some kind almost everywhere, so that only a small central space is nearly smooth. Metapleura with faint scaly-reticulation overlying the reticulate rugosities. Lobe of the hind tibia with 4 distinct shining spines, the one farthest from the shorter spur placed at mid-apical point of the lobe.

Petiole about 2½ times as long as the propodeum, its sculpture as in *tydeus* sp. n.

Length : 6 mm. without ovipositor.

PHILIPPINES : Mindanao, Butuan, 1 ♀ (*Baker*).

Type in U.S. National Museum.

Although I have compared this species with *vahalis*, it is certainly more closely related to *tydeus* ; indeed, it is not without misgiving that I accept it as distinct from this species. The sculpture of the thorax is extremely similar (in case of mesonotum, identical) but *vulturnus* has more raised rugosity on propodeum, mesopleura and metapleura. But the propodeum of *vulturnus* has only a trace (strong enough to mark a difference between it and the strongly shining propodeum of *vahalis*) of the ground sculpture so characteristic of *tydeus*. Probably of special significance is the presence of the 4 spines on the apical lobe of the hind tibia, since the group of *imbecillus* as a whole seems to be largely characterised by the absence of these. Again, the bright yellow apex of the antenna is likely to have at least subspecific value. If more material should show that I have attached too much importance to the differences mentioned above, then *vulturnus* will need to be considered merely as a subspecies of *tydeus*.

Spathius elicius sp. n.

Differs from *vahalis* as follows :—

♀. Petiole pale throughout.

Antenna with 44 segments (1 ♀). Mesonotum slightly more gibbose in front, falling less gradually to the pronotum; posterior carinae moderately well defined, slightly more divergent anteriorly. Basal carina a little longer than its forks; areola defined but its outline irregular. Hairs of the upper surface of the hind tibia shorter, hardly 1½ times as long as its middle width; hind tarsus 1 twice as long as 2, its long hairs slightly less erect than those of its tibia; 3 a trifle shorter than 5, 10 : 11. Radius arising nearer the middle of the stigma. Tergite (2 + 3) completely smooth.

Length : 4·5–6 mm. without ovipositor.

MALAYA : Singapore, 2 ♀♀, one the type (*Baker*). BORNEO : Sandakan, 1 ♀ (*Baker*).

Type in U.S. National Museum.

This is the only species in the group with smooth first segment of the gaster and by this character in combination with the long first segment of the hind tarsus it is readily distinguishable.

Spathius festus sp. n. (fig. 243).

♀. Honey-brown with the gaster a little darkened above and its sides somewhat yellowish. Legs more or less honey-yellow; hind coxae and hind femora with a rather faint brownish suffusion; hind tibiae brown on about apical half and at extreme base, otherwise honey-yellow. Fore-wings faintly brownish; stigma yellowish on about basal $\frac{2}{5}$.

Head only slightly narrower behind the eyes than across them, 10 : 11. Eyes rather large; when the head is seen from above, the shortest distance between them is very slightly less than their length. Face transversely rugose-reticulate, the sculpture somewhat weak. Vertex with indication of very feeble striation which fades out at a considerable distance from the eye-margin and is absent on the temples. Antenna with at least 49 segments; pubescence of flagellum unusually short and inconspicuous; flagellum 1 exactly as long as scape plus pedicel. Ocelli in a triangle with base considerably longer than sides.

Thorax: Pronotal keel free; lateral area with strong smooth ridges. Mesonotum falling fairly steeply but no means vertically to the pronotum (fig. 243); posterior carinae more or less parallel, very wavy; short, thick transverse rugae branch off from these ridges but they encroach very little on to the lateral lobes, which are hence, in greater part, shining and very finely sculptured. Scutellum almost flat, with weak surface sculpture. Propodeum not at all elongate; basal carina well defined, slightly longer than its forks; areola clearly delimited, confluent with the petiolar area, the surface within it, as well as that of the dorsal areas except at base, with strong transverse rugae. Metapleura strongly striate-reticulate. Disc of the mesopleura strongly shining but not quite smooth, there being the faintest indication of a ground sculpture and of obsolescent punctures and rugulosities; subalar impression hardly impressed, carinate, fairly thickly pubescent; furrow costate. Radius of the fore-wing leaving stigma at middle; recurrens nearly interstitial; nervus parallelus not interstitial. Legs: hind coxa very bluntly, almost imperceptibly, angulate beneath at base; hind tibia somewhat stout by comparison with that of the *vahalis*-complex (figs. 237 and 242); hairs of its upper surface hardly longer than its middle width; apical lobe with 2 stout spines near the shorter spur; hind tarsus 1 twice 2; 3 much shorter than 5 (4 : 7).

Abdomen: Petiole about 2½ times as long as the propodeum, much constricted beyond the spiracles, its sculpture on this part, except for the feeble apical dilatation, with obsolescent transverse rugulosities. Gaster narrowly ovate; tergite (2 + 3) a little longer than apically wide, 11 : 9, with a lateral margin which fades out considerably before the second spiracle; at first sight the surface of this segment appears smooth but on closer examination (× 60) it shows an excessively fine, obsolescent aciculation which is longitudinal on basal half but more or less concentric on apical half; following tergites with the merest trace of aciculation. Ovipositor sheaths about as long as the thorax plus abdomen.

Length: 7 mm. without ovipositor.

MALAYA: Singapore, 1 ♀ (*Baker*).

Type in U.S. National Museum.

This is an interesting species of doubtful affinities. It has much in common with the *vahalis*-group where I have placed it provisionally, namely, elongate form, free pronotal keel, virtual absence of a basal projection on the hind coxa, long slender petiole and narrowly ovate gaster. On the other hand, it differs from that group in a few rather important details; these are :—normal eyes, *i.e.*, they have no tendency to bulge, shorter propodeum and shorter second and third segments of the hind tarsus.

Spathius phalanthus sp. n.

♀. Head evenly pale honey-yellow; mesonotum slightly deeper in tint than the head, appearing reddish; propodeum, metasternum, a streak on the side of the pronotum and the mesopleural furrow, blackish. Legs entirely pale honey-yellow except that the hind femora have a dark patch on each side. Stigma of the fore-wing yellowish on about basal half, thence becoming gradually darker. Tergite (2 + 3) yellowish with a large brown medial patch; tergites 4–6 with an obsolescent brownish patch.

Head distinctly narrower behind the eyes than across them. Face rugulose with distinct transverse elements. Vertex entirely smooth. Frons with fine striation. Ocelli arranged in a triangle with base clearly longer than sides. Antenna broken; flagellum 1 as long as scape plus pedicel.

Thorax: Pronotal keel well developed, widely separated from the posterior margin of the pronotum. Mesonotum sloping very gradually to the pronotum and, except along the course of the notaulices, its sculpture very fine, appearing almost shagreened; posterior carinae uniting just behind the middle to form a single fine ridge which extends to the posterior margin; in one female, only this posterior ridge is present, the anterior forks being obsolete; vestiture of the mesonotum consisting of dense minute adpressed hairs in addition to longer, sparse, outstanding ones. Basal carina of the propodeum 3–4 times as long as its forks; these latter very ill defined; dorsal areas at base with rather wide scaly-reticulation. Mesopleura decidedly not smooth, showing obsolescent rugosity. Sides of the thorax thickly hairy, long and short hairs being present, but on the whole the long hairs are the more conspicuous. Hind coxa without a trace of a projection; lobe of the hind tibia virtually without spines, only 1–2 fine spines being present near the shorter spur; hairs of the upper surface of the hind tibia about twice the middle width of the tibia, set at about 60 degrees; hind tarsus 1 slightly less than twice 2, 7 : 4. Nervus parallelus interstitial. Second abscissa of radius distinctly longer than 1st intercubitus, but less so than in *olearus* sp. n. (cf. fig. 244).

Abdomen: Petiole twice as long as the propodeum. Gaster narrowly ovate but not at all parallel-sided. Tergite (2 + 3) slightly longer than its apical width, about 43 : 40, with feeble longitudinal striation on rather more than basal half, the intervals between the ridges rugulose; apical part of tergite (2 + 3) with much finer striation, the rugulosity of the intervals appearing stronger; the difference in sculpture marks two distinct, though not sharply separated areas. Tergite 4 with a vague reticulate-rugulose sculpture. Ovipositor sheaths about as long as thorax plus abdomen.

Length: 5 mm. without ovipositor.

BORNEO: Sandakan, 4 ♀♀, one the type (*Baker*). PHILIPPINES: Mindanao, Zamboanga, 1 ♀ (*Baker*); this female has the stigma more or less yellow throughout.

Type in U.S. National Museum.

Spathius olearus sp. n.

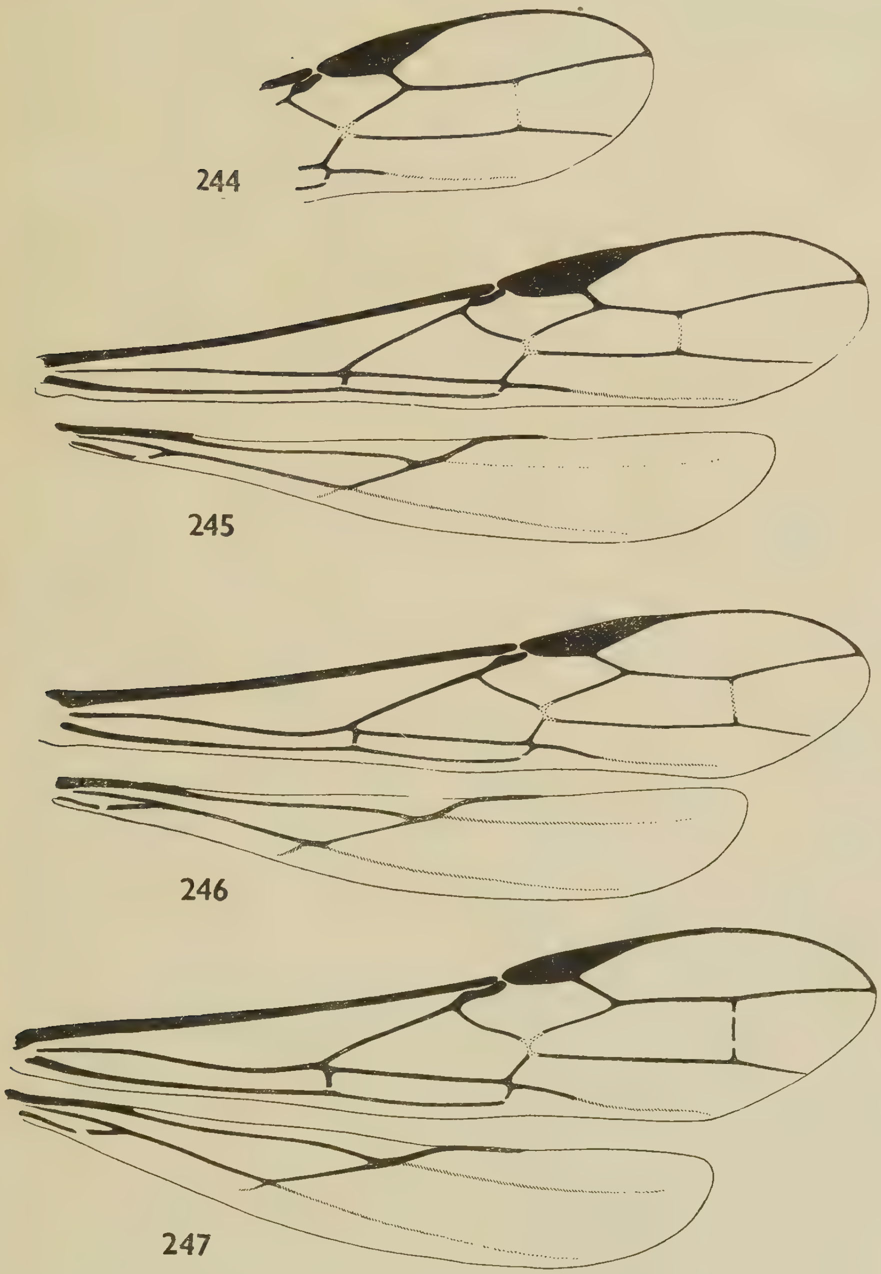
In sculpture of tergite (2 + 3) and pubescence of thorax, this species closely resembles *phalanthus*, though in general form it approaches much more closely to the typical members of the *imbecillus*-group than does *phalanthus*. It may be compared with this species as follows :—

♀. Head and thorax slightly more reddish in tint. Propodeum in the type suffused with blackish above and mesosternum with a deeper red tint; in the second female, the thorax is unicolorous; tergite (2 + 3) brown along the middle; yellow along sides; the yellow part is dilated to form a pair of ill-defined patches on each side, of which the posterior pair is the larger; in the type these markings are much better defined than in the second female; tergites 4 and 5 with an ill-defined brown medial patch. Hind femora suffused with brown except at ends. Stigma pale on less than basal half.

Antenna with 48 segments.

Posterior carinae of the mesonotum uniting as in *phalanthus* to form a single posterior ridge. Areola of the propodeum rather less well defined; in the type, not at all delimited on the right side. Subalar impression of the mesopleura separated from the disc by a distinct, weakly branching carina. Fore-wing (fig. 244).

Petiole slightly less than 3 times as long as the propodeum. Gaster considerably narrower, approaching a parallel-sided condition, dull, about twice as long as its apical width, 65 : 32; its basal width slightly more than half its apical width; on a little less than



Figs. 244–247.—Wings of *Spathius* :—244. *Spathius olearus* sp. n.; 245. *S. vahalis* sp. n.; 246. *S. priapus* sp. n.; 247. *S. caenius* sp. n.

basal ⅔ the sculpture consists of fine wrinkly striation, the intervals rugulose; apical to this area, the striation is still finer; in the paratype, the longitudinal element in the sculpture of this apical area is almost lost so that the surface is finely rugose; tergite 4 with a fine, more or less semicircular aciculation in the type, curving about the mid-basal point; in the second female, the aciculation is mostly broken up to form extremely fine rugose-reticulation.

Length: 6 mm. without ovipositor.

MALAYA: Singapore, 2 ♀♀, one the type (*Baker*).

Type in U.S. National Museum.

A large female from Borneo, Sandakan, differs slightly from typical *olearus* as follows:—The vertex shows faint traces of transverse striation; the ridge separating the subalar impression of the mesopleura from the central convexity is broken down to form a plexus of rugae; propodeum more shining, its rugae thicker and virtually extending to anterior margin so that the ill-defined dorsal areas show no fine surface sculpture; tergite (2 + 3) fully twice as long as apically wide, more rugose than in *olearus*, the longitudinal element in the sculpture hardly present, even towards base.

Spathius pyrrhus sp. n.

In the shape of the abdomen closely resembling *phalanthus* but certainly a good species and differing from *phalanthus* as follows:—

♀. General coloration darker; head honey-brown with a reddish tint; lower part of the mesopleura, mesosternum, propodeum and metapleura almost black; petiole dark brown; tergite (2 + 3) pale brown on about basal ⅔, dirty yellow at apex; to the naked eye, the gaster appears brown, faintly marked with yellow around the sides of the apical half.

Frons with stronger, coarser striation. Vertex medially with faint indication of transverse striation; this takes the form of short linear grooves, narrowly separated along the middle line.

Pronotal keel, where it forms the anterior margin of the lateral areas, stronger. Hairs of the mesonotum taken all together, longer; virtually no contrast of long and short hairs; sculpture of mesonotum coarsely reticulate-rugose, the rugosities spreading virtually over the entire surface of the lateral lobes. Propodeum strongly shining, everywhere with strong striate-reticulation, the smooth rugae more or less transverse on each side of the basal carina; areola and dorsal areas not defined. Mesopleura coarsely reticulate-rugose everywhere, the rugosities much raised.

Petiole about twice as long as the propodeum, without obvious longitudinal ridges, except within the apical dilatation, shining, its rugosity vague, obsolete; towards base almost smooth above. Basal area (brown) of tergite (2 + 3) evenly rugulose and without an obvious longitudinal element in the sculpture; apical area with fine, somewhat broken aciculation which is transverse medially but longitudinal towards sides and hence appears to curve about the mid-basal point.

Length: 5 mm. without ovipositor.

PHILIPPINES: Mindanao, Butuan, 1 ♀ (*Baker*).

Type in U.S. National Museum.

This species is essentially characterised by the coarse sculpture of the mesonotum and of the mesopleura.

Paraspathius gen. n.

Characters: Species of slender build, differing essentially from *Spathius* in the structure of the antennal scape; this is elongate, cylindrical, fully twice as long as wide measured on longest side, and has its apical rim distinctly reflexed (fig. 256) except in *rabirius* sp. n., a species which on all other characters is quite naturally a member of the genus. Thorax long and narrow (fig. 257). Pronotal keel very strongly developed, free. Mesonotum very feebly declivous in front, its lobes virtually not differentiated, the notaulices clearly defined only at their origin; vestiture of the mesonotum consisting of long outstanding hairs, except in *dindymus* sp. n., a decidedly aberrant species. Legs: hind coxa at least $\frac{2}{3}$ as long as hind femur; hind femur short and thick, at base beneath with a short transverse keel, very feeble in *dindymus* sp. n., which in profile shows as a tooth; at base the hind femur is very abruptly narrowed, more especially on its upper side. Wings narrow; recurrens nearly interstitial. Petiole long and narrow; gaster also long and narrow; tergite (2 + 3) always sculptured and laterally with a sharply differentiated margin which extends to as far as the 2nd spiracle. Size large: 5–10 mm., usually nearer 10.

♂. Second abscissa of the subcostella sometimes considerably thickened, stigma-like.

MALAYA. BORNEO. PHILIPPINES. Five species, one subspecies and one variety.

Type of the genus:—*Paraspathius periparetus* sp. n.

Key to the species of **Paraspathius**.—Females.

1. Mesonotum clothed densely with pale glistening adpressed pubescence as well as with long hairs . . . . *dindymus* sp. n.
–. Mesonotum clothed only with long outstanding hairs . . . . 2.
2. Outer side of the hind tibia striated; sculpture of tergite (2 + 3) consisting predominantly of fine rugosity; tergite 4 with a complete or almost complete lateral margin . . . . 3.
–. Outer side of the hind tibia without striation; sculpture of tergite (2 + 3) consisting predominantly of fine smooth or nearly smooth aciculation; tergite 4 without a trace of a lateral margin . . . . 4.
3. Head contrasting reddish; segment 1 of the hind tarsus very long, slightly longer than the mesosternum as viewed from the side . *periparetus* sp. n.
–. Head brown, not much paler than the rest of the body; segment 1 of the hind tarsus not particularly long, shorter than the mesosternum as viewed from the side . . . . *proculus* sp. n.
4. Head and thorax black; lateral area of the pronotum smooth everywhere *usipetes* sp. n.
–. Head and thorax pale reddish; lateral area of the pronotum with some rugosity at least posteriorly . . . . *rabirius* sp. n.

Paraspathius periparetus sp. n. (figs. 255 and 257).

♀. Head contrasting reddish; rest of the body dark brown to blackish. Front coxae honey-yellow; middle coxae honey-yellow with a brownish suffusion beneath in large individuals; hind coxae blackish or dark brown like the thorax; hind femora and trochanters blackish or dark brown; front and middle femora a little paler than the hind femora; hind tibiae dark brown, slightly paler towards apex but black at extreme base; front and middle tibiae brown, slightly paler towards apex. Ovipositor sheaths yellowish towards apex but black at tip. Stigma unicolorous, brown throughout.

Head very slightly narrower behind the eyes than across them, approaching a subcubical condition. Face coarsely reticulate-rugose with a transverse tendency. Frons smooth, shining, except for a shallow medial channel which is transversely costate. Vertex with a patch of coarse, obsolescent striation on each side; similar striation is sometimes vaguely indicated on the temples; four or five punctures margin the eye above; back of head behind the eyes smoothly striate on about posterior $\frac{2}{3}$. Base of the ocellar triangle obviously longer than its sides. Antenna broken but with at least 63 segments; scape in a dorsal view slightly more than twice as long as wide, its lower apical margin reflexed to form a flange which is hardly developed on the outer side of the scape, *i.e.* where the scape is shortest (fig. 256); flagellum 1 as long as scape.

Thorax virtually 3 times as long as wide. Lateral area of the pronotum with strong, smooth, transverse rugae. Posterior $\frac{2}{3}$ of the mesonotum strongly smoothly transversely sulcate, the sulcation not broken by any indication of the usual 2 posterior carinae (fig. 248). Scutellum, including its anterior foveae, hardly pubescent. Propodeum: spiracular areas densely pubescent; basal carina sometimes not defined; dorsal areas shining, covered all over with smooth, mostly transverse rugae. Mesopleura smooth, shining, the furrow showing as a smooth, narrow groove. Hind coxa very slightly shorter than its femur, 7 : 8, strongly smoothly transversely fluted above; hind tibia on its outer side strongly longitudinally striated; apical lobe with a single small spine near the shorter spur; segment 1 of the hind tarsus very long, distinctly longer than the greatest length of the mesosternum, viewed from the side, and $2\frac{1}{2}$ times as long as 2; 3 very slightly shorter than 5, 9 : 11 (fig. 250); segment 1 of the middle tarsus about 5 times as long as wide. Wings (fig. 249).

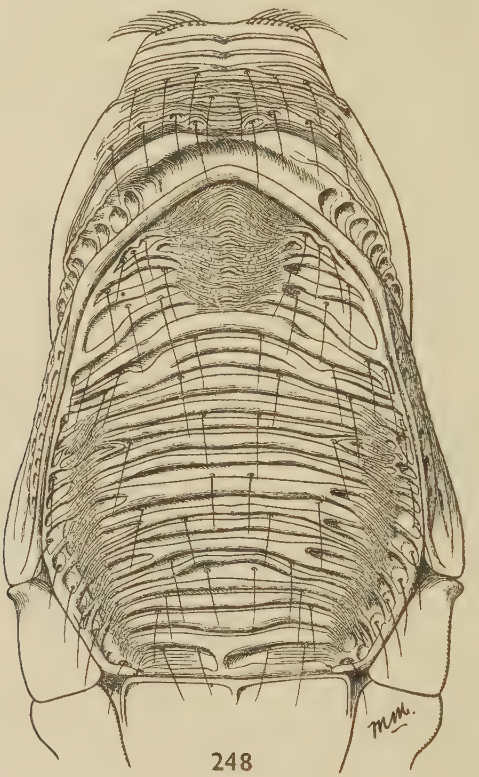


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FIG. 248.—*Paraspathius periparetus* sp. n., mesonotum.

Abdomen: Petiole $2\frac{1}{2}$ to 3 times as long as the propodeum; except for the apical dilatation which is dull and rugulose, the surface very shining, in places almost smooth, the sculpture, where present, consisting of obsolescent, mostly transverse rugosity. Tergite (2 + 3) about $2\frac{1}{2}$ times as long as apically wide, dull, extremely finely rugulose-punctate, but becoming faintly shining and transversely aciculate at apex; following tergites similarly but more finely sculptured and with a relatively and progressively larger area of transverse aciculation; tergite (2 + 3) sharply margined to apex, 4 almost to apex. Ovipositor sheaths about as long as the abdomen plus thorax.

Length: 8–10 mm. without ovipositor.

MALAYA: Singapore, 4 ♀♀, one the type (*Baker*). BORNEO: Sandakan, 2 ♀♀ (*Baker*).

Type in U.S. National Museum.

In fig. 255 tergite 8 is fully exserted.

Paraspathius periparetus subsp. **mindanaoensis** subsp. n.

Differs from the nominotypical form as follows:—

♀. Middle and front femora bright reddish-brown, contrasting sharply with the black hind femora; all the tibiae except at extreme base, which is darkened, bright reddish-brown.

Striation of the vertex stronger; that on the head behind the eyes also stronger and more extensive and extending virtually to as far as the genal suture; in *periparetus*, the sculpture does not reach the genal suture by a considerable distance.

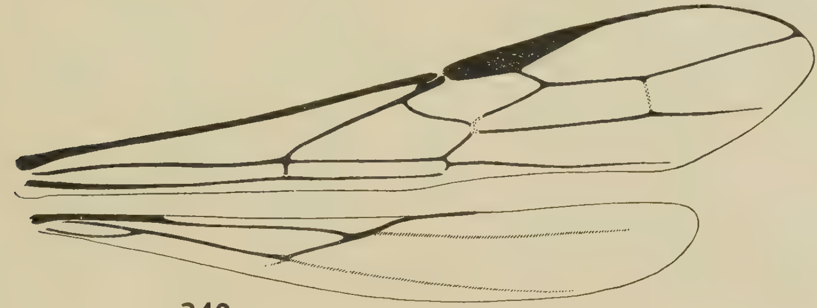

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FIG. 249.—*Paraspathius periparetus* sp. n., wings.

PHILIPPINES: Mindanao, Iligan, 2 ♀♀, one the type (*Baker*). Kolambugan, 1 ♀ (*Baker*).

Type in U.S. National Museum.

Paraspathius periparetus var. **sarawakensis** var. n.

In spite of rather striking sculptural differences, I do not feel inclined to regard this insect as anything more than a variety of the nominotypical form. It differs from *periparetus* as follows:—

♀. Head blackish-brown like the thorax. Vertex strongly and somewhat confluently transversely striated. Mesonotum deeply transversely sulcate so that on the lateral lobes only a narrow band of fine ground sculpture is left free. Hind tibia reddish, black at extreme base; between the black and the red is an area of honey-yellow.

BORNEO: Sarawak, Mt. Matang, 17.xii.1913, 1 ♀ (*G. E. Bryant*).

Type in British Museum (Natural History).

This variety differs from *mindanaoensis* in dark head and stronger sculpture of vertex.

Paraspathius proculus sp. n.

This species differs from *periparetus* as follows :—

♀. Head only a little paler than the blackish or dark brown thorax, appearing brown to the naked eye; round patches on each side of the frons clearly reddish. Tibiae a little paler but all of them slightly darker at base.

Striated patch on each side of the vertex much smaller in size, the striation itself appearing as a complex of short, irregular transverse sulci with a few deep foveae interspersed. Antenna with about 50 segments.

Mesonotum without the characteristic transverse sulcation; posterior carinae present but close, parallel, broken and wavy; the transverse rugae which branch off from these carinae extend to about the middle line of the lateral lobes; the lateral lobes thence to their feebly foveolate lateral margin with only a fine surface sculpture; in *periparetus*, the lateral margin of the lateral lobes has well-marked transverse rugae so that in this latter species only a narrow linear zone of fine sculpture is left free. Spiracular areas of the propodeum slightly less thickly pubescent; basal carina and areola clearly defined in the four specimens studied; sculpture of the dorsal areas rather less transverse in tendency. Hind coxa not obviously transversely fluted all over, the ridges being more or less longitudinal or subreticulate along the sides of the coxa; the intervals between the raised rugosities are on the whole finely rugulose; basal segment of the hind tarsus much shorter, very slightly shorter than the greatest length of the mesosternum and $2\frac{1}{4}$ times as long as 2; 3 much shorter than 5, about $\frac{2}{3}$ as long; middle tarsus shorter, segment 1 being about 3 times as long as wide.

Petiole shorter, twice to $2\frac{1}{2}$ times as long as the propodeum. Tergite (2 + 3) shorter, about twice as long as apically wide. Ovipositor considerably shorter, its sheaths about as long as the abdomen plus half the thorax.

Length : about 6 mm. without ovipositor.

BORNEO : Sandakan, 3 ♀♀, one the type (*Baker*). MALAYA : Singapore, 1 ♀ (*Baker*).

Type in U.S. National Museum.

Altogether this species is far less slenderly built than *periparetus*; the difference in build is especially noticeable in the abdomen.

Paraspathius usipetes sp. n.

♀. Head and thorax deep black. Scape, pedicel, front and middle legs throughout, hind tibiae and hind tarsi honey-yellow; hind coxae brown with a reddish suffusion above; hind femora dark brown, also with a reddish suffusion above. Extreme apex of the stigma yellowish. Tergites 4–6 yellowish above.

Head rather strongly transverse, strongly narrowed behind the eyes (fig. 258), altogether lacking the subcubical appearance of *periparetus*; in a lateral view of the head, the oral margin is more strongly raised and more prominent than in *periparetus* (cf. fig. 257). Face very shining, strongly and very irregularly punctate-reticulate; towards the cheek the sculpture forms itself into shining irregular transverse rugae. Frons almost entirely smooth, with two or three little transverse foveae on each side of, and close to, the middle line. Vertex highly polished, with only a few scattered punctures, more especially towards the temples, from which long hairs arise. Head behind the eyes without a trace of striation, only a few scattered punctures present from which arise hairs. Scape measured along its longest side twice as long as wide; its apical reflexed flange feebly developed; flagellum broken.

Thorax : Lateral areas of the pronotum completely smooth; all that part of the pronotum anterior to, and at sides ventral to, the area is virtually smooth; in addition to the short dense pubescence, the posterior corner of the pronotum, *i.e.* against the tegulae, has strong smooth rugae. Mesonotum with rather numerous long hairs; notaulices not defined, their imaginary course and the posterior surface of the mesonotum covered with a few strong, broken but obsolescent rugae mixed with large scattered punctures; no trace of posterior carinae; on the posterior part of the mesonotum the transverse rugae are almost obliterated. Scutellum thickly and conspicuously pubescent on each side anteriorly. Basal carina of the propodeum well defined, about twice as long as its forks; dorsal areas clearly delimited, their surface somewhat matt, covered all over with a very close scaly-reticulation; spiracular areas with traces of pubescence along their outer side. Mesopleura, except towards the postero-ventral corner where there is some obsolescent rugosity, highly polished, including the furrow which is feeble and very narrow. Hind coxa lacking the characteristic oval appearance of *periparetus*, clearly shorter than its femur, about 27 : 35; hairs of the upper surface of the hind tibia a little more than twice its middle width; apical lobe with 3 almost imperceptible spines near the almost wanting shorter spur; apex of the hind tibia outwardly without a trace of striation; hind tarsus 1 hardly $\frac{2}{3}$ as long as the mesosternum and a little more than twice as long as 2; 3 hardly $\frac{2}{3}$ as long as 5; 4 not longer than wide; hind coxa irregularly transversely fluted above. Wings a little less narrow than in *periparetus* (cf. fig. 249).

Abdomen: Petiole $2\frac{1}{2}$ times as long as the propodeum, slightly wider on its thickened, more basal part, that at extreme apex; on about basal $\frac{2}{3}$ strongly shining and almost unsculptured. Tergite (2 + 3) a little more than twice as long as apically wide, smoothly, longitudinally aciculate on about basal $\frac{3}{4}$; at apex, the aciculation becomes transverse. Following tergites transversely aciculate. Ovipositor sheaths about as long as the abdomen plus the propodeum.

Length: 10 mm. without ovipositor.

♂. Differs from the female as follows :—

Frons and scape of the antenna dull reddish. Tergite (2 + 3) more reddish, the following tergites with less yellowish colouring than in the female but more diffused; lower part of the head with a reddish suffusion, especially noticeable on the cheeks behind the genal sulcus.

Head less transverse. Frons with a few strong, oblique rugae on each side in front of the ocelli. Antenna with 45 segments. Mesonotum with more raised sculpture; posteriorly there are strong transverse, irregular rugae and hardly any of the scattered large punctures which are characteristic of the female here. Surface of the dorsal areas of the propodeum more encroached on by short branches of the lateral bounding carinae. Apex of the lobe of the hind tibia with 2 minute spines, placed behind the edge and not projecting beyond it. Hind-wing (fig. 254); 2nd abscissa of the subcostella considerably thickened. Petiole less shining on basal $\frac{2}{3}$, its sculpture more in evidence.

Length: 8·5 mm.

PHILIPPINES: Sibuyan, 1 ♀, the type (*Baker*). Mindanao, Davao, 1 ♂ (*Baker*).

Type in U.S. National Museum.

This species is largely characterised by the sculpture of the mesonotum, pubescence of the scutellum together with the sculpture and colour of the gaster.

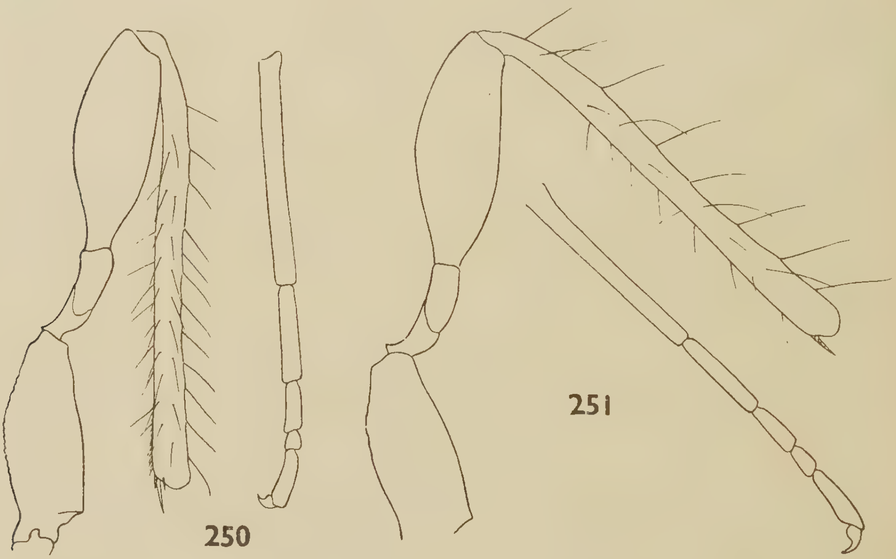
Paraspathius rabirius sp. n.

This species differs from *usipetes* as follows :—

♀. Head honey-brown with a reddish tint. Thorax and abdomen deep reddish. Front and middle legs honey-brown to honey-yellow; hind coxae and hind femora reddish. Stigma of the fore-wing hardly pale at apex.

Head a little more prolonged behind the eyes, thus less transverse. Oral margin less prominent. Face less strongly rugose, less shining, though this may be illusory and due to the pale colour of the face. Frons entirely smooth. Vertex with similar but slightly larger punctures. Antennal scape without a reflexed flange.

Lateral area of the pronotum less smooth, showing feeble, obsolescent rugosities towards the posterior limits; surface anterior to the area with some irregular raised rugosities. Hairs of the mesonotum sparser and more erect. Although the notaulices are not defined as such, their imaginary course is more clearly indicated than in *usipetes* by the presence of short transverse rugae; the posterior patch of rugosity is better defined than in *usipetes*; no trace of punctures on the posterior part of the mesonotum. Scutellum anteriorly less pubescent. Dorsal areas of the propodeum with a smaller area of fine surface sculpture, especially on the posterior half where the surface is very shining and nearly smooth. Hind coxa narrower, more oval, longer in relation to the femur, 13 : 16, lacking the smooth fluted appearance but becoming, on outer side towards base, rugose; hairs of the hind tibia sparser, a little longer and more erect (fig. 251); apical lobe without spines (× 60); shorter spur apparently wanting; hind tarsus more slender, segment 1 twice as long as 2; 3 longer in proportion to 5; 4 considerably longer than wide; segments of the middle tarsus longer.



Figs. 250–251.—Hind leg of *Paraspathius*:—250. *Paraspathius periparetus* sp. n.; 251. *P. rabirius* sp. n.

Length : 5·5 mm. without ovipositor.

♂. Like the female, except for the usual sexual differences; 2nd abscissa of the subcostella of the hind-wing shorter and thicker than in the male of *usipetes* (fig. 253).

Length : 5·5 mm.

Borneo : Sandakan, 1 ♀, the type, 2 ♂♂ (*Baker*).

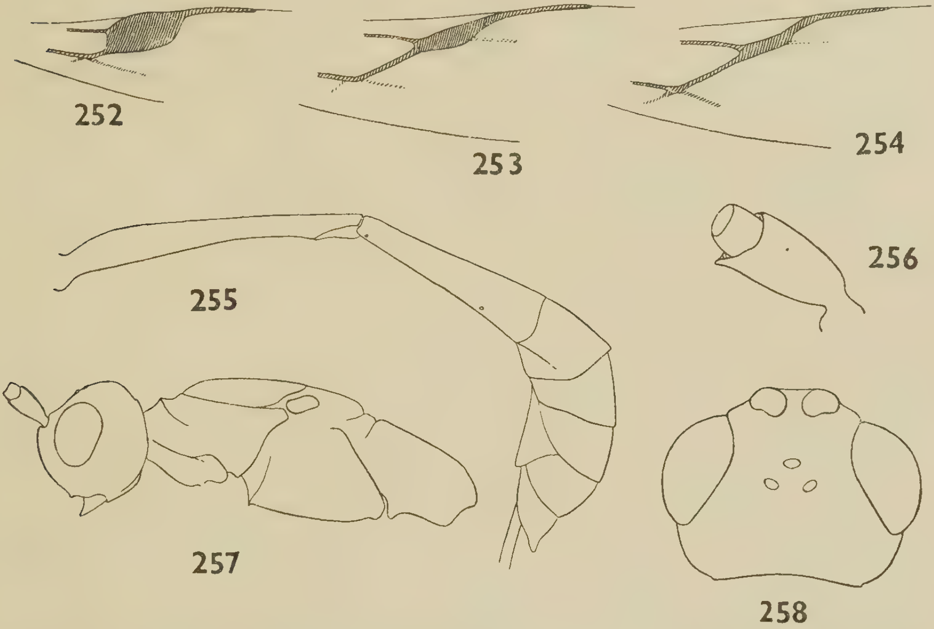
Type in U.S. National Museum.

This species and *usipetes* are evidently related and differ from the subgroup of *periparetus* in having the apical flange of the antennal scape less developed or absent, the scutellum more pubescent, no striation on the outer side of the hind tibia and differently sculptured tergite (2 + 3). The hind-wing of the male has the 2nd abscissa of the subcostella thickened to form a sort of false stigma. Tergite 4 is without a trace of a lateral margin.

Paraspathius dindymus sp. n.

♀. Head fulvous; thorax blackish with a faint reddish tint, noticeable more especially on the pronotum; gaster dull brownish; petiole darker than gaster and with a more pronounced reddish tint than the thorax. Hind coxa and hind femur brown; hind tibia honey-yellow throughout. Stigma evenly brown throughout.

Head markedly narrower behind the eyes than across them. Face reticulate-rugose. Frons with somewhat vague transverse rugosity and with traces of scaly-reticulation. Vertex transversely striate, the ridges subconfluent. Base of the ocellar triangle very slightly longer than its sides. Antenna broken but with at least 40 segments; scape with a rather feebly reflexed apical flange, at least on lower side.



Figs. 252–258.—252. *Paraspathius dindymus* sp. n., part of hind-wing, ♂; 253. *P. rabirius* sp. n., part of hind-wing, ♂; 254. *P. usipetes* sp. n., part of hind-wing, ♂; 255. *P. periparetus* sp. n., abdomen, lateral; 256. *P. periparetus* sp. n., scape of antenna; 257. *P. periparetus*, head and thorax, lateral; 258. *P. usipetes*, head, dorsal.

Thorax seen from the side cylindrical, nearly 3 times as long as its greatest depth, 20 : 7. Pronotum thickly clothed with short bristly hairs; the large area towards the tegulae strongly rugose. Mesonotum dull and appearing finely rugose, densely covered with pale, glistening, adpressed pubescence, out of which scattered long hairs arise; notaulices faintly indicated by a slight coarsening of sculpture, but not impressed; where they meet posteriorly the surface becomes rugose-reticulate but there is virtually no indication of the smooth transverse rugae here which occur in *periparetus* sp. n. and its allies. Scutellum dull, pubescent, finely sculptured, its anterior foveae ill defined, rugose, touching the posterior margin of the mesonotum. Propodeum: basal carina about twice as long as its forks; dorsal areas clearly defined, twice as long as basally wide, dull, in greater part shagreened. Mesopleura thickly pubescent, rugulose, the rugulosity consisting of puncture-like impressions and other inequalities of surface. Nervus parallelus more or less interstitial. Legs : hind coxa a little more than ⅔ as long as its femur, at base with a very feeble transverse keel; hind tibia with very feeble indication of striation on outer side; hairs of its upper surface very sparse, a little more than twice its middle width; hind tarsus 1 not unusually long, slightly more than twice 2, 28 : 13; 3 is ¾ of 5.

Abdomen : Petiole very long and narrow, feebly rugose. Gaster long, narrow, a little widened towards apex; tergite (2 + 3) a little more than twice as long as apically wide, about 20 : 9, smoothly and extremely finely aciculate; the aciculation is longitudinal on basal ⅔ to ¾ and beyond this transverse; laterally this tergite has a very feeble margin which does not reach the 2nd spiracle. Ovipositor sheaths a little longer than the whole abdomen.

Length : about 5·2 mm. without ovipositor.

♂. Like the female, but the hind-wing with a very large false stigma (fig. 252); this is much more strongly developed than in the males of the other species of *Paraspathius* where similar modification takes place.

MALAYA : Singapore, 8 ♀♀, one the type, 1 ♂ (*Baker*).

Type in U.S. National Museum.

An extremely distinctive species, differing at once from the other members of the genus by the densely pubescent mesonotum.

Pseudospathius Szepligeti.

Pseudospathius Szepligeti, 1902, *Természetr. Füz.* **25** : 58.

Large brilliantly coloured species; the head yellow or reddish-yellow,; the thorax in greater part red (except apparently in the genotype); petiole and gaster black. Antennae blackish or dark brown throughout. Front and middle legs, except that the middle coxae may be darkened, bright reddish-yellow; hind tibiae unicolorous, brownish or blackish. Wings deeply and evenly infuscated; stigma not pale at base.

Head not or only a little widened behind the eyes, more or less subcubical. Scape large, fully 1½ times as long as wide measured on longest side. Frons and vertex smooth. Occiput margined. Pronotal keel well developed, free, lying slightly below the level of the posterior margin of the pronotum. Mesonotum sloping rather abruptly to the pronotum, its middle lobe prominent and somewhat gibbose; the 3 lobes are strongly shining and more or less smooth; notaulices deep; posterior carinae strongly developed, long. Basal carina of the propodeum as long as its forks; dorsal areas distinctly longer than wide and at least on anterior half with a large polished area. Middle part of the metapleura shining and with large punctures. Mesopleura smooth, shining, the furrow smooth, short, widened and deepened posteriorly. Hind coxa simple; hairs of the upper surface of the hind tibia hardly equal to its middle width; apical lobe with 5 minute spines; hind tarsus 1 twice 2; 3 very short, only a trifle longer than 4 and less than half as long as 5, 7 : 16. Recurrens very nearly interstitial. Abdomen of typical Spathiine form; gaster rather long and narrow; tergite (2 + 3) rather finely sculptured all over, considerably longer than wide at apex and with a complete, sharply differentiated lateral margin; its dorsum divided by a fine suture into its two component parts, the epipleura of which are completely separated. Ovipositor about as long as the whole body.

Type of the genus :—*Spathius tricolor* Szepligeti.

NEW GUINEA. SOLOMONS. Two species and one variety.

The above diagnosis does not necessarily cover the genotype, which is unknown to me. Nevertheless it is highly probable that I have interpreted the genus correctly, for Szepligeti's description, though short, does mention a number of salient points. When he erected *Pseudospathius*, he gave no reasons for placing it among the DORYCTINAE (1902 : 56); if my interpretation of it is correct, the genus has all the essential features of the SPATHIINAE and quite naturally belongs here.

Pseudospathius tricolor Szepligeti.

Spathius tricolor Szepligeti, 1900, *Termèszetr. Füz.* **23** : 55, ♀.

Head cubical. Clypeus transversely striated. Face coarsely punctate, with two curved furrows which cut off a spear-shaped area. Frons flat, smooth. Vertex smooth. Scape a little compressed (flagellum missing). Mesonotum smooth, tri-lobed, in front of the scutellar depression with three deep channels, which are connected with the deep, crenulate notaulices (the surface damaged by pin). Pleura smooth, with a furrow which widens posteriorly. Metanotum rugose, with pit-like impressions against the carinae and with five longitudinal carinae, of which the two middle ones are joined at the base; area supero-externa and dentipara separated. Abdomen rugose, gradually more finely so towards posterior end; second suture distinct, linear. Coxa oval, not truncate; hind femur short thick.

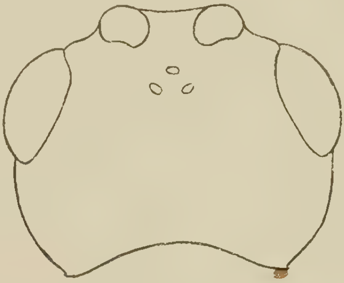


FIG. 259.—*Pseudospathius ornatus* sp. n.: head, dorsal.

Black; head, prothorax, front and middle legs and the hind femora yellow; metanotum red; middle coxae marked with black; hind tarsi and apices of the tibiae brown. Wings dark brown; stigma and venation black; basalis and medius with a (darker) border.

Length: 14 mm., ovipositor the same.

NEW GUINEA: Astrolabe Bay, Stephansort, 1897, one example (*Biró*).

The above description is a translation of the original.

Pseudospathius ornatus sp. n.

♀. Head deep yellow; propodeum and metapleura coal-black; rest of thorax red. Antennae black throughout. Palpi yellow. Middle coxae in greater part infuscated; hind coxae black; hind femora pale above, except at base and becoming progressively and more extensively paler towards apex; hind tibiae and basal segment of the hind tarsus (rest of tarsus missing) brownish-black.

Head as wide behind the eyes as across them (fig. 259). Face below the antennal insertions intricately rugose but between the eye and the clypeus shining, smooth, except for large shallow, ill-defined punctures. Ocelli almost in an equilateral triangle, placed far forward on vertex (fig. 259). Eyes rather small, their longer axis not much longer than the malar space, 7 : 5. Antenna very long, 90-segmented in paratype; scape large in proportion to the size of the head, about twice as long as wide, measured on longest side; flagellum 1 slightly shorter than scape plus pedicel; hairs of the flagellum very dense, much shorter than the width of the segments.

Thorax: Lateral area of the pronotum almost smooth throughout but not delimited. Mesonotum falling almost vertically to the pronotum, its middle lobe gibbose and prominent; lobes smooth, shining, but not highly polished, an excessively faint roughness being present; posterior carinae strongly developed, bordering the inner edge of the notaulices to clearly beyond middle; hairs rather short, sparse, outstanding but quite inconspicuous. Scutellum almost flat, more or less smooth. Areolation of the propodeum very well defined; basal carina strong, thick, as long as its equally strong forks; dorsal areas longer than wide; on their basal half, the surface in greater part smooth, highly polished, but on apical (narrower) half, it is widely punctate-reticulate; areola and area petiolaris confluent. Metapleura thickly and evenly hairy all over; medially shining and with large punctures; the intervals between the punctures smooth; on lower half, the punctures become much more crowded and the surface coarsely rugose. Mesopleural furrow smooth, terminating posteriorly in a large smooth hollow, which is strongly margined on posterior half; disc smooth and shining. Legs: hairs of the upper surface of the hind tibia hardly equal to its middle width; apical lobe with 5 minutes spines. Nervus parallelus nearly interstitial; nervulus more or less interstitial but tending to be slightly antefurcal.

Abdomen: Petiole nearly twice as long as the propodeum, 9 : 5, coarsely reticulate-rugose but becoming obliquely carinate on each side of the apical dilatation. Gaster elongate, about 1⅓ times as long as its apical width; dorsal surface of tergite (2 + 3) closely rugose-reticulate but towards the apex the sculpture weakens to punctate-reticulation, the apical margin being smooth; tergite 4 sharply reflexed laterally but the margin not completely differentiated; the surface of this and of the following tergites dull and becoming progressively more faintly roughened.

Length: 15 mm. without ovipositor.

NEW GUINEA: Huon Gulf, Morobe Dist., 22.v.–19.vi.1937, 1 ♀, the type (*J. L. Froggatt*); Madang, 9.v.1941, 1 ♀ (*B. A. O'Connor*).

Type in British Museum (Natural History).

Pseudospathius ornatus var. **kietaensis** var. n.

Differs from the nominotypical form as follows :—

♀. Head only slightly more yellowish than the yellowish-red thorax; thorax entirely and uniformly, hind coxae, hind trochanters and hind femora yellowish-red; hind tibiae and tarsi brown. Antennal scape brownish. Wings considerably paler.

Head slightly less cubical and distinctly a little narrower behind the eyes than across them.

Middle lobe of the mesonotum a little less gibbose in front. Basal carina of the propodeum and its forks less thick; dorsal areas on posterior half smooth except for a few large punctures or punctiform impressions; areola separated from the area petiolaris by a not very strong keel.

The reticulation of tergite (2 + 3) is straightened out to form very irregular, much-broken, longitudinal wrinkles.

Length: 11·8 mm. without ovipositor.

SOLOMONS: Bougainville Is., Kieta, 10.ii.1935, 1 ♀ (*J. L. Froggatt*).

Type in British Museum (Natural History).

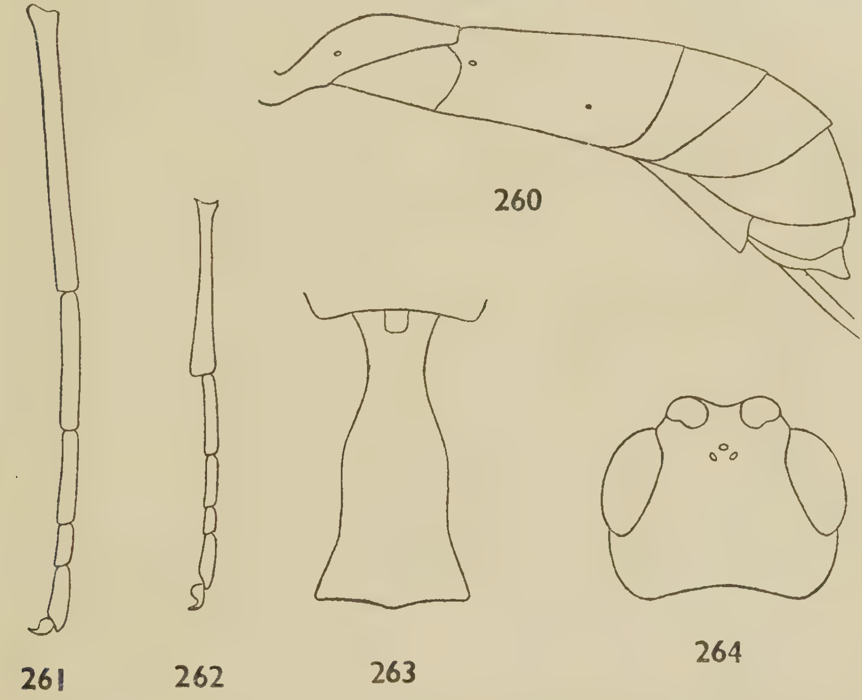
It is possible that this insect may represent a well-defined geographical form of *ornatus*, for the colour differences are quite striking. For the moment, however, and until further material comes to hand, the best course seems to be to regard it simply as a variety.

Pseudospathius jacobsoni Szepligeti (see appendix).

Sisupala gen. n.

Brilliantly coloured species marked with yellow, black and ivory white.

♀. Head more or less subcubical, only very slightly narrower behind the eyes than across them (fig. 264). Vertex completely smooth. Occiput not margined. Pronotal keel undeveloped. Lobes of the mesonotum shining, almost smooth, with only the merest trace of surface sculpture; notaulices present, deep; hairs of the mesonotum very sparse, short and restricted to the course of the notaulices, more or less. Legs: front tarsus almost twice as long as its tibia; hind coxa without a projection but very bluntly angled at base; apical lobe of the hind tibia with a complete row of 6 spines; hind tarsus very slender; segment 1 twice as long as 2; 3 nearly 1½ times as long as 5, 17 : 12; 4 is 2½ times as long as wide (fig. 261). Nervus parallelus interstitial. Petiole short, only a little longer than the propodeum, strongly and evenly widened from spiracles to apex, in profile strongly arched (fig. 263); its surface virtually smooth all over; the epipleura of the petiole extend forwards very distinctly anterior to middle; gaster long, narrow, about 2½ times as long as its greatest width. Ovipositor sheaths as long as the whole body.



Figs. 260–264.—*Sisupala splendida* gen. et sp. n.:—260. abdomen, lateral; 261. hind tarsus, ♀; 262. hind tarsus, ♂; 263. petiole, ♀; 264. head, dorsal, ♀.

♂. Tarsi less slender; segment 3 of the hind pair as long as 5.

Fiji Is. One species.

Type of the genus:—*Sisupala splendida* sp. n.

This genus differs at once from all the other genera I include in the Spathiinae in having the occiput unmargined.

Sisupala splendida sp. n.

♀. Head yellow except for a narrow black mark along the inner margin of the eye; thorax reddish-yellow; petiole ivory-white with a brownish patch at apex; gaster virtually black, except for a small triangular pale mark on each side of the basal margin of tergite $(2 + 3)$; the inner angles of these marks are prolonged inwards so that they become narrowly joined along the basal margin of tergite $(2 + 3)$; ventral surface of the abdomen, more especially beneath the petiole and beneath tergite $(2 + 3)$, ivory-white; elsewhere the ventral surface of the gaster, including the epipleura of the tergites, is marked and spotted with ivory-white. Scape and pedicel dark brown; flagellum black except for 7–8 preapical yellow segments. Except that the apical tarsal segment of all legs is darkened, the legs are reddish-yellow throughout. Wings dark fuscous throughout; the veins of both wings yellowish towards the wing base. Palpi yellow. Ocelli in a dark brown spot.

Head: Face nearly smooth but finely rugulose broadly down the middle and elsewhere with scattered punctures. Frons with rather fine smooth striation. Antenna broken but with at least 36 segments; pedicel twice as long as its greatest width; flagellum 1 a little shorter than scape plus pedicel; flagellum markedly tapering towards the apex and, except for the pale segments, densely clothed with black bristly hairs which on the more basal segments are about $\frac{2}{3}$ the width of the segments. Ocelli small and inconspicuous, placed in front of the middle transverse line of the head. Eyes rather large.

Thorax: Lateral area of the pronotum smooth-looking, with only feeble transverse ribs. Notaulices closely, strongly, evenly costate; posterior depression of the mesonotum with a number, about 6–7, of close longitudinal ridges, among which the 2 normal carinae do not appear to be emphasised. Scutellum feebly convex, almost smooth, its anterior depression wide, and with 6–7 close longitudinal costae. Basal carina of the propodeum about $\frac{1}{2}$ as long as its strongly divergent forks; areola delimited only above by the strong forks of the basal carina; elsewhere without delimiting carinae and confluent with the area petiolaris; the area thus formed is very feebly longitudinally excavated and strongly, transversely rugose throughout; dorsal areas somewhat obliquely placed, their surface shining, almost smooth, except around the edges. Mesopleural disc smooth, shining; furrow consisting of a row of sharply defined foveae. Hind femur rather abruptly narrowed at base; hairs of the upper surface of the hind tibia short, semi-erect, about $\frac{1}{2}$ to $\frac{2}{3}$ the middle width of the tibia; spines of the apical lobe thin and rather uneven in appearance. Recurrens received into the base of the 2nd cubital cell at a distance from the 1st intercubitus equal to $\frac{1}{3}$ its own length; 2nd abscissa of radius clearly longer than 1st transverse cubitus; stigma rather sharply pointed towards apex.

Abdomen: Surface of the petiole virtually smooth all over. Gaster (fig. 260). Ovipositor sheaths a trifle longer than the whole body.

Length: 10 mm.; ovipositor 12 mm.

♂. In colour like the female but the underside of the gaster with 3 pairs of large sharply discrete brown patches on the ivory-white surface. Antenna with 51 segments; 20 dark segments apical to the pale ones. Hind tarsus rather markedly narrowed from base to apex; the widening is due to a flange on the lower side which is hardly developed towards base but increases in depth towards apex (fig. 262). Petiole narrower than in the female and with traces of obsolescent sulcation towards apex; one of the two males bears a curious and very prominent protuberance at the apex of the gaster; it involves tergites 7 and 8 and the apical margin of 6 and in profile appears as a large rounded prominence; it is entirely absent in the second male and is possibly nothing but a curious malformation.

Length: 7 mm.

FIJI IS.: Ovulau, 23.xi.1927, 2 ♂♂, 2 ♂♂, one female the type (*H. W. Simmonds*).

Type in British Museum (Natural History).

This is a very striking-looking insect and must be regarded, I think, as an aberrant member of the Spathiinae. The shape of the petiole is unique within the subfamily.

Platyspathius Viereck.

1911, *Proc. U.S. Nat. Mus.* **40** : 185.

Characters: Rather dark brown, almost chocolate brown species; sometimes suffused with reddish in part; rarely entirely red-brown or even yellowish-brown (*dinoderi* Gahan). Antennae usually markedly yellowish with the apical 5–10 segments darkened, sometimes sharply so. Palpi always more or less blackish. Legs always dark, except sometimes the tarsi; the hind femora and tibiae unicolorous; the latter never paler at base but sometimes darker than their femora. Fore-wings always conspicuously dappled with black and white (fig. 281).

Head somewhat cubical, at most only a little narrower behind the eyes than across them. Vertex always with a characteristic sculpture of scaly-reticulation. Pronotum without a clearly defined transverse keel such as occurs in *Spathius*. Mesonotum frequently without raised sculpture posteriorly and in such cases the notaulices abbreviated; the lobes always in far greater part with a scaly-reticulate sculpture similar to that of the vertex; hairs of the mesonotum extremely sparse, adpressed, sometimes virtually wanting. Scutellum varying from slightly convex to quite strongly convex. Propodeum always unareolated, somewhat flattened above and without a posterior declivous surface; its sculpture predominantly like that of the vertex; a pair of thickened keels, enclosing the spiracles, is always present on each side. Legs: hind coxa always with a dentiform projection beneath at base (feeble in *thyone* sp. n.); hairs of the upper surface of the hind tibia always shorter than its middle width; apical lobe of the hind tibia with 3–5 inconspicuous spines; front and middle femora with a blister-like swelling near the base above. Medius of the fore-wing deeply curved downwards just beyond middle so that the submedian cell is constricted before apex; recurrens received into the base of the 2nd cubital cell. Petiole gradually widened from spiracles to apex, with a characteristic sculpture of extremely fine punctate-reticulation; sometimes short, broken wrinkles are superimposed on this sculpture; tergite (2 + 3), except in *turneri* sp. n., with a clearly defined transverse furrow, dividing the segment into its two component parts; the epipleura of the true 2nd and 3rd tergites always separated; tergites (2 + 3)–5 always with a sharp, completely differentiated lateral margin; apical corners of tergites (2 + 3) and 4 frequently with a blister-like swelling; epipleura of the petiole extending to about the spiracle, that is, much beyond middle. Ovipositor variable in length but never as long as the whole body.

Africa. Indo-australian Region. Eight species.

Type of the genus :—*Platyspathius pictipennis* Viereck. Monobasic.

This genus, as well as the two related genera, *Toka* gen. n., and *Parana* gen. n., present an interesting case of evolutionary convergence. In my opinion, the affinities of this group of genera are not with the true Spathiinae, but rather with the Doryctine genus *Rhaconotus* Ruthe. The resemblance, however, is so close that for the sake of convenience I have treated the group in this work. Three significant features separate *Platyspathius* from *Spathius* : (1) the blister-like swelling on the front and middle femur, (2) the gradual widening of the petiole from spiracles to apex and (3) the unfused epipleura of the true second and third tergite. Of these characters, (1) and (3) are diagnostic features of *Rhaconotus*. The dappled fore-wing of *Platyspathius* and its venation are typical of certain sections of *Rhaconotus*, as interpreted by me (see Nixon, 1941 : *R. atys* Nixon and *R. polycrates* Nixon, figs. 22 and 23). I am acquainted with one species, *Rhaconotus cassander* Nixon (1943), which seems to bridge the gulf between the two genera and to make their separation less easy than would appear to be the case if merely typical forms of each genus were taken into consideration.

Platyspathius (including *Toka* and *Parana*) may be compared with *Rhaconotus* as follows :—

(A). Abdomen sessile; tergite 1 being usually from 1 to 1½ times as long as apically wide (if rarely longer then the petiole with *complete* longitudinal ridges as in *cassander* Nixon or the vertex smooth as in *mahensis* Wilkinson); tergites 1–4 with a characteristic and dominant sculpture of longitudinal striation . . . . *Rhaconotus* Ruthe.

(B). Abdomen petiolate; tergite 1 rarely as short as 1½ times as long as apically wide and then with a characteristic sculpture of fine punctate reticulation (*Toka* gen. n.); tergites 1–4 with a characteristic and dominant sculpture (more especially on petiole and basal part of tergite (2 + 3) of extremely fine punctate-reticulation; if longitudinal rugosities occur on the petiole, they are always in the form of feeble, much-broken wrinkles, never in the form of *complete* striation *Platyspathius* Vier.

Eventually, the *Platyspathius–Rhaconotus* group of genera will, in my opinion, need to be combined in a single tribe;[1] the use of a higher category than this would not be justified as far as my experience enables me to judge. The correct allocation of this tribe, however, will be difficult until the genera which now make up that amorphous subfamily, the DORYCTINAE, have been critically studied and combined into various tribal or subfamily units. Whatever course is followed, it will be necessary, if the classification of the BRACONIDAE is to give anything like a true picture of relationships, so to arrange in relation to each other the true SPATHIINAE, as typified by *Spathius*, and the *Platyspathius–Rhaconotus* group of genera as typified by *Rhaconotus*, that their obvious affinity, even though not close, will be kept in sight.

The use of the name *Platyspathius* is unfortunate but unavoidable. The insects are not in the least flattened. Viereck was evidently much impressed by the form of the petiole of the species (*pictipennis*) he described; its dorsal surface is certainly somewhat flat, but this is due largely to the absence of raised rugosity.

Key to the species of *Platyspathius*.—Females.

1. Antenna with 21 segments; suture of tergite (2 + 3) only very faintly indicated and virtually without costulae . . . . . *turneri* sp. n.
–. Antenna with at least 24 segments; suture of tergite (2 + 3) clearly defined, with distinct, though sometimes extremely short, costulae . . . . . . 2.
2. Furrow of tergite (2 + 3) with only very short feeble costulae. (Spp. with that part of tergite (2 + 3) basal to the furrow without traces of longitudinal wrinkles) . . . . 3.
–. Furrow of tergite (2 + 3) with very distinct costae which frequently extend as fine ridges beyond the confines of the furrow itself. (Spp. with tergite (2 + 3) basal to furrow often with traces of longitudinal wrinkles) . . . . 4.
3. Head distinctly swollen behind the eyes (fig. 272) . . *pictipennis* Viereck.
–. Head not swollen behind the eyes . . . . *dinoderi* Gahan.

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[1] Fahringer (1928, *Opus. brac.*: 8) has divided the Doryctini of Ashmead into two sub-tribes, the Rhaconotini and the Doryctini, including *Rhaconotus* and a number of other genera in the former, but he gives no reasons for this step.

4. Mesonotum posteriorly with a considerable amount of raised, longitudinally rugose or striate-reticulate sculpture; notaulices complete throughout, though merging posteriorly into the rugosities of the posterior depression *clymene* sp. n.
–. Mesonotum posteriorly with at most the merest trace of a fine longitudinal ridge, the surface being scaly-reticulate like the rest of the mesonotum; notaulices, if present, distinct to middle . . . . 5.
5. Ovipositor sheaths much longer than gaster plus petiole; no hyaline spot within the 1st discoidal cell; the hyaline fascia which cuts the base of the stigma and apex of the 2nd discoidal cell not interrupted in the middle *dice* sp. n.
–. Ovipositor sheaths not longer than gaster plus petiole; a hyaline spot present within the 1st discoidal cell; the hyaline fascia which cuts the base of the stigma widely interrupted in the middle by pigmentation and dark pubescence . . . . 6.
6. Eyes behind and above margined with pale colouring; greatest distance between the posterior ocelli at least equal to the distance between one of them and the eye-margin . . . . 7.
–. Eyes behind and above not margined with pale colouring; greatest distance between the posterior ocelli very distinctly less than the distance between one of them and the eye-margin . . . . *pyrene* sp. n.
7. Ovipositor sheaths not much more than half the length of the whole abdomen; notaulices so short as hardly to have longitudinal direction (at first sight absent); all the tibiae blackened . . . . . . *thyone* sp. n.
–. Ovipositor sheaths about as long as the abdomen; notaulices long enough to have obvious longitudinal direction; all the tibiae brownish *bisignatus* Walker.

Males.

1. Eyes above margined with a streak of paler colouring . . . . 2.
–. Eyes above not thus margined. . . . . 3.
2. All the tibiae blackish; hind femur strongly swollen . . . . *thyone* sp. n.
–. All the tibiae brownish; hind femur of ordinary form . *bisignatus* Walker.
3. Flagellum abnormal, segments 1 to about 8 being thickened and a little widened at apex, giving the flagellum a notched appearance *dinoderi* Gahan.
–. Flagellum of more or less simple form . . . . 4.
4. Hind tibia swollen medially and distinctly narrower at apex *pictipennis* Viereck.
–. Hind tibia not swollen medially and not narrower at apex . . . . . . 5.
5. A hyaline spot within the 1st discoidal cell . . . . . *pyrene* sp. n.
–. No hyaline spot within the 1st discoidal cell . . . . *clymene* sp. n.

Platyspathius bisignatus (Walker).

Spathius bisignatus Walker, 1860, *Ann. Mag. nat. Hist.* **5** (3) : 309, ♀.
Stenophasmus signipennis Walker, Enderlein, 1912, *Arch. Naturgesch.* **78** (A2) : 11.
Spathius dinoderi Gahan, Wilkinson, 1931, *Trans. ent. Soc. Lond.* **79** : 510.
Spathius bisignatus Walker, Wilkinson, 1931, *Trans. ent. Soc. Lond.* **79** : 510 (part).

♀. Dark brown to almost black; to the naked eye, virtually black; the eyes above are margined with pale fulvous-brown and the face is entirely of this colour. All the tibiae and femora red-brown; tarsi much the same colour as their tibiae but a little paler. Apical 6–9 segments of the flagellum darkened, but not sharply so. Within the 1st discoidal cell is a large hyaline patch.

Head slightly narrower behind the eyes than across them; posteriorly having a sharply truncate appearance, the sides behind the eyes being nearly straight; the vertex in profile forms a straight line between the posterior ocelli and the occipital margin (fig. 274). Face closely shagreened, virtually without a trace of transverse elements. Vertex extremely delicately scaly-reticulate, the meshes slightly elongated in the transverse direction; the surface has a decidedly smooth appearance. Greatest (overall) distance between the posterior ocelli equal to the distance between one of them and the eye-margin. Eyes rather large.

Thorax: Mesonotum sloping fairly abruptly to the pronotum, posteriorly without a trace of raised sculpture; the lobes together form an even convexity; notaulices sharply defined to about middle, thence completely obliterated. Scutellum strongly convex, the convexity having a slightly longitudinal direction. Wings: 2nd abscissa of the radius a trifle longer than the 3rd, about 21 : 19; radius leaving stigma virtually at middle. Hairs of the upper surface of the hind tibia clearly longer than those on the lower surface and about half the width of the tibia. Mesopleural furrow only very weakly impressed. Wings (fig. 281).

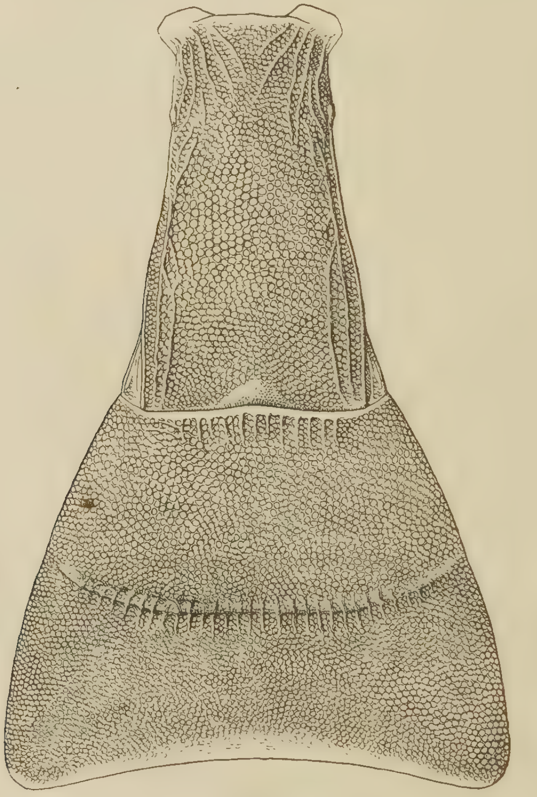

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FIG. 265.—*Platyspathius bisignatus* Walker: petiole and tergite (2 + 3).

Abdomen: Petiole almost 3 times as long as apically wide, 19 : 7, posteriorly and laterally sometimes with a few raised rugosities. Furrow of tergite (2 + 3) rather deep, curved, situated very decidedly distal to middle, its costae strong, sometimes extending as fine ridges beyond the confines of the furrow nearly to middle of the area posterior to it. Ovipositor sheaths about as long as the whole abdomen.

Length: 3–4·2 mm. without ovipositor.

♂. Hind femur and hind tibia showing no peculiarity. Antenna missing.

S. INDIA: Madras, Coimbatore, 25.i.1930, 4 ♀♀, found near cage containing culture of *Pempheres* sp. United Provinces, Dehra Dun, Lachiwala Range, 18.xi.1920, 1 ♀, "ex *Dalbergia sissoo*"; Dehra Dun, 1 ♂, 11.v.1922, "ex *Albizzia procera*", 8.x.1923, 1 ♀, "ex *Sterculia alata*" (*C. F. C. Beeson*). Palghat, Sappal, 2.vi.1930, 1 ♀, "ex *Albizzia lebbek*" (*J. C. M. Gardner*). CEYLON (type locality). MALAYA: Sepang, 16.vii.1925, 2 ♀♀, bred from *Sinoxylon anale* Jesue (*G. H. Corbett*). PHILIPPINES: Luzon, Mt. Makiling, 2 ♀♀ (*Baker*). Los Baños, 2 ♀♀ (*Baker*).

Type in British Museum (Natural History).

I have been puzzled by a single female from Borneo, Sandakan (*Baker*), which I refer to this species provisionally; it differs from the nominotypical form as follows:—furrow of tergite (2 + 3) very shallow, situated at middle, its costae in the form of very fine striation which reaches virtually the apex of the segment; very delicate ridges occur over the entire surface of the petiole.

Platyspathius bisignatus Walker, as interpreted by Wilkinson (1931), is composite and consists of three species, namely, the true *P. bisignatus* (Walker), *P. dinoderi* (Gahan) and *P. pictipennis* Viereck.

On account of the shape of the head, this species could be confused only with the following insect, in the description of which the differences will be pointed out.

Platyspathius thyone sp. n.

Here is a species extremely closely allied to *bisignatus* and, on the shape of the head, forming with it a subdivision of the genus; it differs from *bisignatus* as follows:—

♂♀. More nearly black; face blackish but the eyes above similarly margined with paler colouring. All the tarsi reddish-yellow, except the apical segment, which is black; femora, tibiae and hind coxae more or less black.

♀. Greatest (overall) distance between the posterior ocelli clearly greater than the distance between one of them and the eye-margin, 4 : 3. Mesonotum, at first sight, appearing as an unbroken convexity, the notaulices very short, absent on the dorsal surface, having only transverse direction. Costae of the furrow of tergite (2 + 3) a little stronger, extending as fine ridges to apex of segment; basal area of tergite (2 + 3) everywhere with fine broken wrinkles superimposed on the ground sculpture. Ovipositor sheaths about as long as the gaster.

♂. Hind femur quite strongly swollen (fig. 277).

Length: ♂♀, 5·2 mm. without ovipositor of female.

INDIA: Central Provinces, Buldana, Sagoda, 1 ♀, the type, 1 ♂, bred, ii.1928, "ex *Balanites roxburghii*".

Type in British Museum (Natural History).

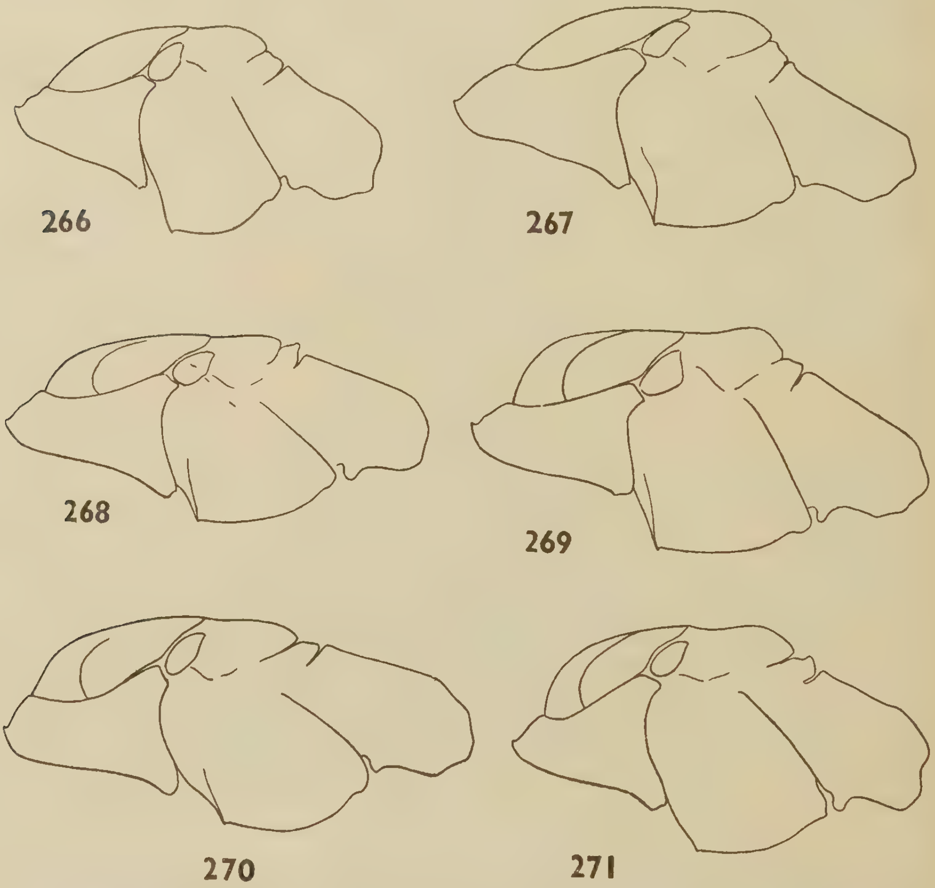
The mesonotum of this species has a very characteristic appearance.

Platyspathius dinoderi (Gahan).

Spathius dinoderi Gahan, 1925, *Philipp. J. Sci.* **27** : 84, ♂.
Spathius bisignatus Walker, Wilkinson, 1931, *Trans. ent. Soc. Lond.* **79** : 510 (part).

♀. Yellowish-brown to deep mahogany-brown; in darkest examples the head is paler than most of the thorax; middle lobe of the mesonotum paler than the other two; this is more especially noticeable in darkest examples. Legs brownish throughout, but the hind tibiae usually darker than their femora. Apical 5–9 segments of the flagellum a little darkened but by no means sharply so.

Head as wide behind the eyes as across them, the sides gently rounded to the occipital margin; the vertex in profile forms a well-defined curve between the posterior ocelli and the occipital margin (fig. 275). Face shagreened and with only excessively weak transverse elements. Vertex markedly shining, the sculpture appearing as if almost smoothed out. Antenna with 28-32 segments (6 ♀♀); flagellum 1 a trifle longer than scape plus pedicel, 11 : 9. Eyes rather small.



Figs. 266–271.—266. *Toka glabrivena* gen. et sp. n., thorax, lateral; 267. *Parana clotho* gen. et sp. n., thorax, lateral; 268. *Platyspathius clymene* sp. n., thorax, lateral; 269. *P. dice* sp. n., thorax, lateral; 270. *P. dinoderi* Gahan, thorax, lateral; 271. *P. pictipennis* Viereck, thorax, lateral.

Thorax : Seen from the side, the pronotum and the anterior slope of the mesonotum lie more or less in a straight line (fig. 270); notaulices deeply impressed, extending a little beyond middle and terminating within a well-marked depression in which there are usually 2 or 3 feeble wrinkles; the lateral lobes are markedly convex and tend to slope a little abruptly on their inner side, adding emphasis to the depth of the posterior mesonotal depression. Scutellum only very slightly convex, and in profile hardly raised above the level of the mesonotum. Hairs of the upper surface of the hind tibia very distinctly longer than those on the lower side and ½ to ⅔ as long as the middle width of the tibia; hind tarsus 3 as long as 5. Fore-wing: 2nd abscissa of the radius distinctly shorter than the 3rd, about ⅔ to ¾ as long; radius leaving stigma at middle.

Abdomen: Petiole 2½ times as long as apically wide, without a trace of longitudinal elements over most of its surface; at base without prominent angular expansions on each side; its epipleura reaches or almost reaches the spiracle. Furrow of tergite (2 + 3) situated beyond middle, curved, deep, its costae very short, not extending beyond the limits of the furrow itself; the entire segment (apart from the costae of the furrow) is virtually without longitudinal rugulosities; tergite 4 with only a very shallow impression across its base, its sculpture similar to that of the rest of the tergite. Ovipositor sheaths as long as or a trifle longer than the whole abdomen.

♂. Basal 7–8 segments of the flagellum considerably thickened and a little swollen at apex, so that this part of the flagellum has a somewhat notched appearance (fig. 273); the apical segments are normal, slender, filiform; in very small males the 2 types of flagellar segments are not readily distinguishable. Hind femur swollen but the hind tibia of ordinary form (fig. 276).

Length: ♂♀, 3·5–4·5 mm. (Small ♂♂ from the Philippines are only 2 mm.)

India: United Provinces, Jawalapur, Sharanpur, 18 ♀♀, 5 ♂♂, "ex *Dendrocalamus strictus*"; Najibabad, 8 ♀♀, 3 ♂♂, "ex bamboo"; Dehra Dun, Jhajra, 1 ♀, "ex *Shorea robusta*"; Dehra Dun, Lachiwala, 1 ♀; Dehra Dun, 2 ♀♀, "ex bamboo". Madras, Nilambur, 1 ♀, "ex *Bambusa arundinacea*". Ceylon: 1 ♀. North Andamans: 1 ♂, "ex *Canarium emphyllum*". Fiji: Koroboya, 1 ♀. Philippines: Luzon, Mt. Makiling, 6 ♂♂, bred from *Dinoderus minutus*. Los Baños, 3 ♀♀, one labelled "on decort. *Cyathocalyx globosa*". Palawan, P. Princesa, 1 ♀ (*Baker*).

The female from Fiji is very dark in colour; the middle lobe of the mesonotum, however, retains its characteristic paleness and is in sharp contrast with the dark lateral lobes.

The appearance of the mesonotum renders this species subtly distinctive in both sexes and the male is easily recognised, also, except in very small specimens, by the modified flagellar segments; in all except one of the 6 males (the largest, 2·8 mm.) from Mt. Makiling, the modification is virtually not apparent. The shape of the head at once distinguishes this species from *bisignatus*. It is much more closely related to the following species, but has a different distribution.

Platyspathius pictipennis Viereck.

Platyspathius pictipennis Vier., 1911, *Proc. U.S. Nat. Mus.* **40**: 185, ♂♀.
Rhaconotus spathulatus Szep., 1914, *Mitt. zool. Mus. Berl.* **7**: 198, ♀.
Spathius bisignatus Walker, Wilkinson, 1931, *Trans. ent. Soc. Lond.* **79**: 510 (part).

A species very closely and naturally related to *dinoderi* Gah., with which it may be compared as follows:—

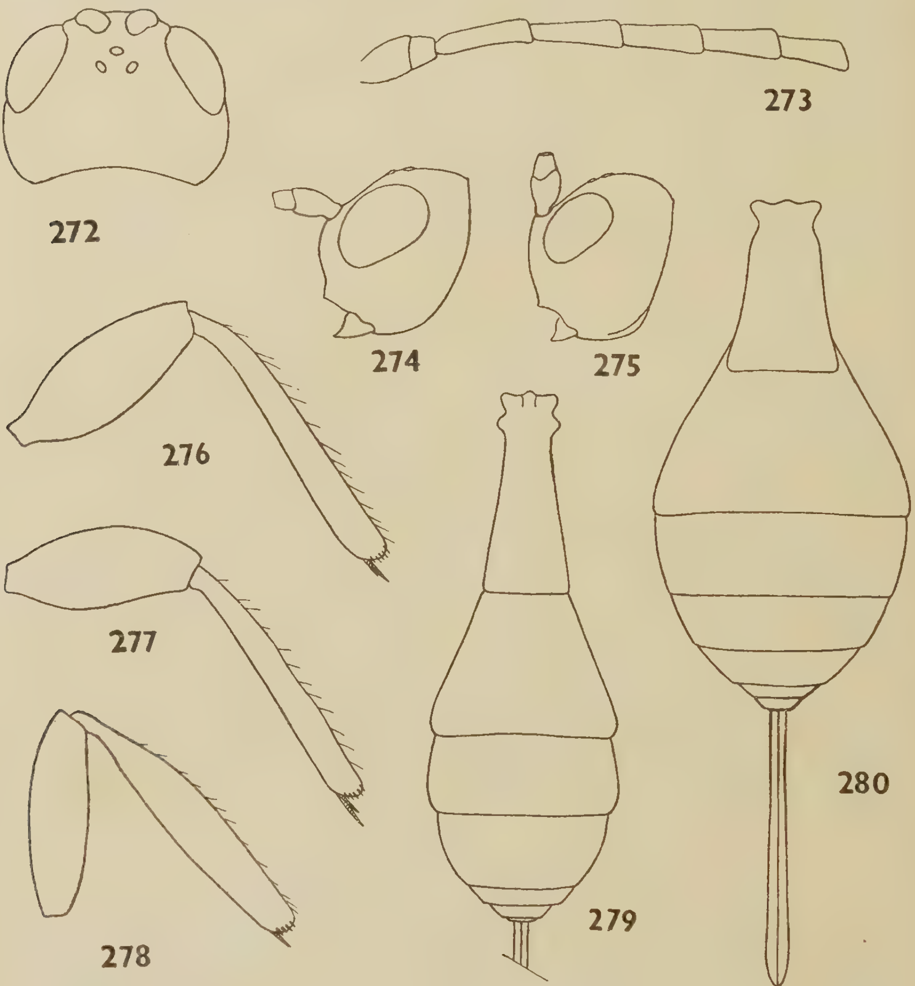
♀. On the whole darker, appearing blackish to the naked eye or dark chocolate, the head frequently paler; forms occur in which the thorax is in greater part suffused with red.

Head clearly a little wider behind the eyes than across them, decidedly cubical (fig. 272). Vertex less shining, sometimes quite dull, the surface almost shagreened. Flagellum after the 1st segment decidedly thicker, the apical 6–8 segments sharply blackened.

Thorax shorter, more compact; seen in profile, the pronotum and the anterior slope of the mesonotum do not lie in a straight line, the slope of the mesonotum being more abrupt (fig. 271); mesonotum slightly transverse, about 37 : 32; in *dinoderi* it is as long as wide; posteriorly the mesonotum shows a single fine carina. Scutellum slightly more convex.

Hairs of the upper surface of the hind tibia not longer than those on the lower side, sparser than in *dinoderi*, very short, only about $\frac{1}{3}$ the middle width of the tibia.

Petiole shorter and wider, about twice as long as apically wide, rarely with minute wrinkles over all its surface; at base with a conspicuous angular expansion on each side. Furrow of tergite (2 + 3) much more shallow, decidedly weak, sometimes without costae; when these are present they are very feeble.



Figs. 272–280.—272. *Platyspathius pictipennis* Vier., head; 273. *P. dinoderi* Gahan, basal segments of antenna, ♂; 274. *P. bisignatus* Walker, head, lateral; 275. *P. dinoderi* Gahan, head, lateral; 276. *P. dinoderi*, part of hind leg, ♂; 277. *P. thyone* sp. n., part of hind leg, ♂; 278. *P. pictipennis* Vier., part of hind leg, ♂; 279. *P. clymene* sp. n., abdomen; 280. *Toka glabrivena* gen. et sp. n., abdomen.

♂. Basal flagellar segments hardly differentiated, that is to say, although they are a little thick, as in the female, there is no contrast between them and the more apical segments as in *dinoderi*. Hind femur not swollen; hind tibia swollen in the middle and distinctly narrower at apex; the basal stalk is rather abruptly attenuated (fig. 278).

Size on the average a little greater in both sexes, largest examples reaching 5·2 mm.

Africa : Pondoland, Port St. John, 1 ♀ (*R. E. Turner*). Uganda, Chuva, 3 ♀♀, 4 ♂♂ (*G. D. H. Carpenter*); Budonga Forest, 1 ♀, 3 ♂♂, associated with Scolytid in bark of mahogany (*H. Hargreaves*). Cameroons, Bibundi, 4.ix.1904, 3 ♀♀ (probably part of the type series of *spathulatus*, since the same data are given by Szepligeti for the type); Uam Territory, Bosum, 1 ♀, 5 ♂♂ (*Tessman*). Transvaal, Louis Trichardt, 1 ♀, " parasite of beetle larva boring in *Eucalyptus* timber ". Portuguese E. Africa, Maputo, Xalasi, *type locality* of *pictipennis*. Madagascar : 1 ♀ (*J. de Gaulle*). Rodrigues I. : 1 ♀ (*H. J. Snell & H. P. Thomassett*).

Type in U.S. National Museum.

The female of this species is characterised by the large subcubical head, transverse mesonotum and feeble furrow of tergite (2 + 3) and the male by the shape of the hind tibia.

Platyspathius clymene sp. n.

This is a species closely resembling *pictipennis* Vier.; for the sake of uniformity, however, I will first compare it with *dinoderi* Gahan :—

♀. Very dark brown, almost black but the head paler; in one female (Natal, Kloof), the head, thorax and petiole are rust-brown.

Vertex duller, having a shagreened appearance. Antenna with 29–34 segments (4 ♀♀).

Mesonotum sloping rather gradually to the pronotum (fig. 268), but the anterior slope not in the same straight line as the pronotum; notaulices deep, foveolate, converging on to a large impressed area in which there is a considerable amount of raised sculpture. The surface of the mesonotum is altogether much less shining. Scutellum markedly convex. Hairs of the upper surface of the hind tibia a little shorter.

Petiole sometimes with fine broken, very short wrinkles, over all its surface; at base with a conspicuous angular expansion on each side. Blister-like swelling at side of tergite (2 + 3) and 4 more strongly developed, the gaster appearing very distinctly notched between these two segments (fig. 279); costae of tergite (2 + 3) extending as fine ridges to apex of segment; the area basal to the furrow sometimes with weak longitudinal elements everywhere. Tergite 4 with very fine, not sharp, vermiculate rugosities extending from the basal furrow over the entire surface of the tergite; sometimes, however, the ridges are much reduced and indistinct. Ovipositor sheaths a little longer than the whole abdomen.

♂. Flagellum of simple form. Hind femur only very slightly more swollen than in the female, not at all exaggerated. Striations of tergite 4 often much reduced but apparently always present, at least as short costae within the furrow itself.

Length : ♂♀, 3·5–4·8 mm.

Africa : Natal, Kloof, 1500 ft., viii–ix.1926, 2 ♀♀, 6 ♂♂ (*R. E. Turner*). Zululand, Gingindhlovu, viii.1926, 1 ♂. Cape Province, Ceres, i–ii.1921, 2 ♀♀, 8 ♂♂ (*R. E. Turner*); Katberg, 19–26.ii.1933, 1 ♀, the type (*R. E. Turner*). Belgian Congo, Katanga, Tenke, 30.vii–9.viii.1931, 1 ♀ (*A. Mackie*); Elizabethville, 11–17.ix.1931, 1 ♀ (*A. Mackie*).

Type in British Museum (Natural History).

Being an African species, *clymene* could be confused only with *pictipennis*; from this species it differs in having the head not swollen behind the eyes, the flagellum more slender, the mesonotum slightly longer than wide, 33 : 31, its posterior surface more sculptured and tergites (2 + 3) and 4 differently sculptured; the male differs in the details of the hind leg. It is altogether a less robust-looking species than *pictipennis*.

Platyspathius dice sp. n.

Differs from *dinoderi* as follows :—

♀. Black-brown but the head paler and the posterior ⅔ of the pronotal collar yellowish-brown, this colour extending as a band to middle of sides; petiole and tergite (2 + 3) suffused with paler colouring. Femora and tibiae very dark brown.

Eyes larger, very distinctly wider above than below, their longer axis a little more than twice the malar space, 24 : 11. Antenna with 37 segments (1 ♀). Face without a trace of transverse elements, merely shagreened. Vertex less shining.

Anterior slope of the mesonotum fairly gradual; in profile, there is a well-defined angle between it and the pronotum. Mesonotum behind virtually without a trace of raised sculpture; lateral lobes less convex. Scutellum strongly convex, in profile conspicuously raised above the level of the mesonotum (fig. 269). Fore-wing : 2nd abscissa of the radius as long as the 3rd; radius leaving stigma very distinctly proximal to middle.

Apical blister-like swelling at sides of tergite (2 + 3) conspicuous, so that there is a distinct notch between this tergite and t. 4. Costate furrow of tergite (2 + 3) as in *dinoderi*. Furrow at base of tergite 4 with traces of feeble costae. Ovipositor sheaths conspicuously longer, almost as long as the abdomen plus thorax.

Length : 5·2 mm.; ovipositor sheaths 4 mm.

Africa : Sierra Leone, Njala, vii.1929, 1 ♀ (*E. Hargreaves*).

Type in British Museum (Natural History).

This species differs from both its African allies, *pictipennis* and *clymene*, in having a longer ovipositor, longer antennae and no raised sculpture on the posterior part of the mesonotum.

Platyspathius pyrene sp. n.

May be compared with *dinoderi* as follows :—

♀. Thorax and abdomen on the whole of a uniform dark brown colour with the head paler but of more or less even tint. Legs more or less honey-brown, a little infuscated on femora and hind coxae.

Face decidedly shining, its ground sculpture feeble and obsolescent. Antenna 25-segmented; flagellum 1 distinctly shorter than 2; in *dinoderi* it is as long as 2.

Anterior slope of the mesonotum slightly more abrupt. Notaulices a little shorter. Mesonotum posteriorly hardly depressed, merely somewhat flattened and without a trace of raised rugosity. Scutellum quite strongly convex, in profile very distinctly raised above the level of the mesonotum. Mesopleural furrow very feeble. Fore-wing : 2nd abscissa of the radius slightly less than ⅔ as long as the 3rd, 11 : 18. Legs shorter; hind tibia more abruptly narrowed at base, the hairs of its lower surface longer, many of them not shorter than those of the upper surface; hind tarsus 3 only about ⅔ as long as 5.

Tergite (2 + 3) with fine striation extending from the furrow and reaching apex of segment, except for the narrow smooth apical margin; surface basal to the furrow also covered with very fine wrinkles; tergite 4 with faint indication of striation, more distinct within the weak basal furrow. Ovipositor sheaths a little shorter than the whole abdomen.

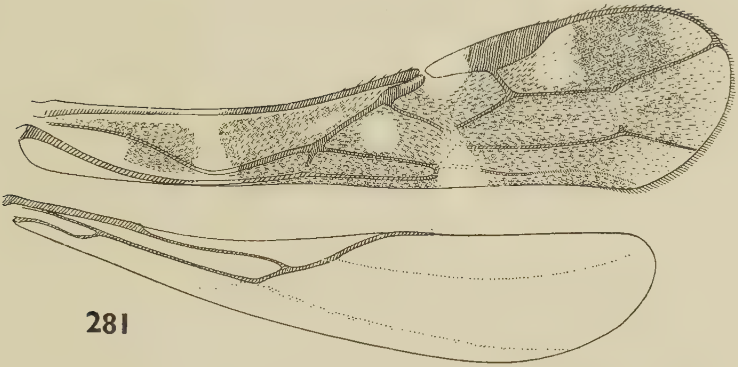
Size much smaller, 2 mm. without ovipositor.

♂. Antenna with 26 segments; basal flagellar segments not modified; flagellum 1 as long as 2. Hind tarsal segments as in the female.

Length : 2·5 mm.

India : United Provinces, Dehra Dùn, 16.iv.1930, 1 ♀, the *type*; 1 ♂ (*J. C. M. Gardner*).

Type in British Museum (Natural History).



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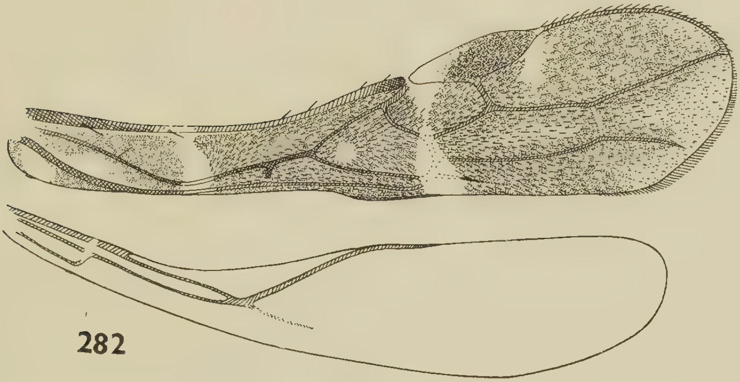

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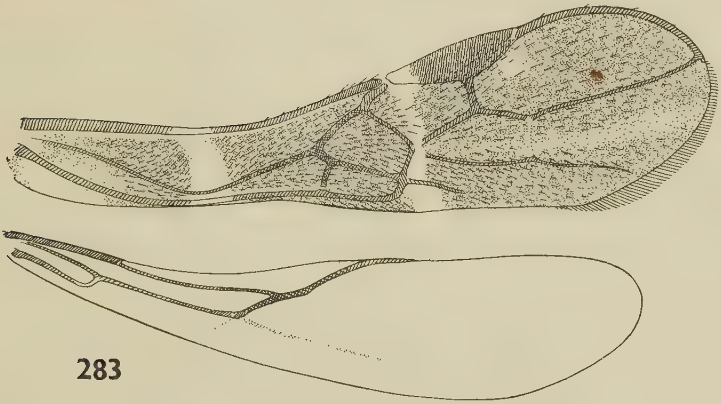

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FIGS. 281–283.—Wings :—281. *Platyspathius bisignatus* Walker; 282. *Parana clotho* gen. et sp. n.; 283. *Toka glabrivena* gen. et sp. n.

Platyspathius turneri sp. n.

May be compared with *dinoderi* as follows :—

♀. Deep mahogany-brown; face around the mouth a little yellowish. Apical 6 segments of the flagellum sharply blackened.

Head in profile somewhat roundly angled between the vertex and frons. Vertex less shining, its sculpture a little stronger. Face shagreened but without a trace of transverse elements. Antenna with 21 segments (1 ♀).

Seen from the side, the mesonotum a trifle more gibbose in front, very slightly transverse, posteriorly with a single fine ridge; notaulices as in *dinoderi*; lateral lobes showing no exaggerated convexity. Hairs of the upper surface of the hind tibia sparse and very short, a trifle shorter than those on lower side and hardly ¼ the middle width of the tibia; hind tarsus 3 distinctly shorter than 5. Mesopleural furrow clearly defined as a narrow groove.

Petiole shorter, twice as long as apically wide and without a trace of longitudinal elements; on each side at base with a conspicuous angular expansion. Tergite (2 + 3) with only the merest trace of a furrow, indicated by a dull, more closely sculptured line, but without a trace of costae. Tergite 4 without a furrow at base. Ovipositor sheaths as long as the petiole plus gaster.

Length: 2·8 mm. without ovipositor.

Africa : Cape Province, Mossel Bay, v.1921, 1 ♀ (*R. E. Turner*).

Type in British Museum (Natural History).

This little species differs from the other African species of *Platyspathius* by its short antennae and by the almost complete obliteration of the furrow of tergite (2 + 3).

Toka gen. n.

Nervulus widely postfurcal, the 2nd discoidal cell in consequence very short; 2nd abscissa of the radius very short, only about ½ the length of the 3rd and not longer than the 1st intercubitus; recurrens interstitial (fig. 283). Abdomen almost sessile, the petiole about 1½ times as long as apically wide.

Any of the above characters will separate the genus from *Platyspathius*.

Type of the genus :—*Toka glabrivena* sp. n. Africa.

Toka glabrivena sp. n.

♀. In greater part deep mahogany-brown; sides of the thorax somewhat reddened; the mesosternum in greater part black; apex of tergite (2 + 3) and 4 with a broad black band; following tergites more or less blackish. Antennae with a reddish tint, the apical 5–8 segments darkened but not abruptly so. Legs brownish with the tarsi a little reddened except for the apical segment.

Head more or less as wide behind the eyes as across them. Face shining, with rather indefinite scaly-reticulation. Vertex shining, the meshes of the scaly-reticulation a little elongate in the transverse direction; in profile, the vertex between the ocelli and the occipital margin is more or less in a straight line. Antenna with 21 segments (2 ♀♀); flagellum 1 a little shorter than 2, 7 : 8.

Thorax: Mesonotum sloping very gradually to the pronotum (fig. 266); posteriorly without a trace of raised rugosity; notaulices completely absent. Scutellum feebly convex. Mesopleura without a trace of a furrow. Propodeum without raised rugosity except for the lateral bounding carina, somewhat coarsely scaly-reticulate, posteriorly approaching a punctate-reticulate condition. Fore-wing very shiny, especially within the radial cell, the shininess probably due to paucity of hairs; metacarpus rather thick and without a fringe of hairs; 2nd discoidal cell widened proximally and about 2½ times as long as its greatest width (fig. 283). Segment 3 of the hind tarsus a little shorter than 5.

Abdomen: Petiole everywhere with close punctate-reticulation. Tergite (2 + 3) without a trace of longitudinal sculpture and without a furrow; the separation between tergites 2 and 3 is extremely faintly indicated by a transverse, non-impressed line whose emphasis depends on a little more shininess and a fading out of sculpture. Ovipositor sheaths a little more than $\frac{2}{3}$ as long as the gaster.

Length: 2·5 mm. without ovipositor.

AFRICA: Cape Province, Pondoland, Port St. John, 1–11.vi.1923, 1 ♀, the *type* (*R. E. Turner*), 15–31.v.1923, 1 ♀ (*R. E. Turner*).
Type in British Museum (Natural History).

Parana gen. n.

Membrane of the fore-wing, proximal to the hyaline fascia which is nearest the base of the wing, without hairs; nervulus widely antefurcal; median cell of the hind-wing very narrow (fig. 282). Epipleura of the petiole very short; tergite (2 + 3) without a trace of a furrow, its apical corners with only the merest trace of a blister-like swelling.

Differs from *Platyspathius* and *Toka* in the details of the wings and the short epipleura of the petiole; in general facies, the genus is strongly reminiscent of some members of the *dissors*-group of *Spathius*.

Type of the genus :—*Parana clotho* sp. n. INDIA.

Parana clotho sp. n.

♀. Brown with a faint yellowish tint, especially noticeable on the propodeum and the petiole; the lateral lobes of the mesonotum are a little darker than the middle one; tergites (2 + 3) and 4 more reddish-brown with a blackish apical band; following tergites more or less blackish. Legs much the same colour as the thorax but the tibiae of a darker and more even brown than their femora.

Head as wide behind the eyes as across them. Face very shining, with only obsolescent trace of scaly-reticulation. Vertex with fine scaly-reticulation; in lateral view the vertex between the ocelli and the occipital margin forms almost a straight line. Antenna broken; flagellum 1 as long as scape plus pedicel. Ocelli in a large triangle with base considerably longer than sides; distance between the posterior ocelli almost as great as that between a posterior ocellus and the eye-margin, 5 : 6.

Thorax: Mesonotum not in the least gibbose in front, sloping gradually and evenly from base to apex (fig. 267); its surface very shining, the scaly-reticulation very fine and superficial; no trace of raised sculpture posteriorly; notaulices feebly indicated but distinct as blackened scratches to about middle. Scutellar shield proper rather small, feebly convex, feebly margined laterally almost to apex; anterior depression divided by a single ridge into 2 smooth-looking hollows. Postscutellum in lateral aspect without a trace of a projection. Propodeum narrow, elongate, lying far below the level of the scutellum, its lateral keels strongly raised, a little convergent posteriorly; surface between these keels without raised rugosity, being evenly punctate-reticulate. Mesopleura without a trace of a furrow. Hairs of the upper surface of the hind tibia hardly longer than those on the lower surface, very sparse, much shorter than the middle width of the tibia; hind tarsus 3 as long as 5.

Abdomen: Petiole narrow, 3 times as long as apically wide, everywhere closely punctate-reticulate; epipleura of petiole reaching to about $\frac{1}{3}$. Tergite (2 + 3) short, transverse, with punctate-reticulation at base but towards apex the sculpture developing into scaly-reticulation; no trace of longitudinal elements in the sculpture of tergite (2 + 3). Ovipositor sheaths a little longer than the gaster.

Length: 3 mm. without ovipositor.

INDIA: North Salem, Jawalagiri, 1 ♀ (*F.R.I. Sandal Insect Survey*).

Type in British Museum (Natural History).

Specifically, this interesting insect is probably largely characterised by its feeble notaulices and the absence of the mesopleural furrow.

APPENDIX.

Below are given in full and arranged in alphabetical order the descriptions of all those species which are unknown to me. It is very probable that some of the species do not belong to the SPATHIINAE as interpreted in this revision.

Metaspathius Brues.

Brues, 1922, *Psyche* **29** : 218, ♀.

"♀. Apterous. Head globular; antennae inserted on a frontal prominence, 17-jointed, scape short and thick, pedicel moniliform; first three flagellar joints much elongated; eyes very small, round; ocelli obsolete; head margined behind; clypeus excavated, leaving a rounded mouth opening; palpi simple; slender. Prothorax elongate; mesonotum without furrows; scutellum small, narrow, shield-shaped; propodeum coarsely reticulated. Legs with the femora much thickened; tibial spurs very small. Abdomen petiolate, the potiole three times as long as broad at apex which is twice as wide as the base, spiracles at the basal fourth, projecting laterally as tubercles; sides of petiole not continuous with the sides of the gaster. Ovipositor slightly longer than the abdomen.

"Type: *M. apterus* sp. nov.

"This genus differs from all other SPATHIINAE known to me in the form of the antennae which have only 17 joints, the basal flagellar joints elongated and the antennae are not attenuate towards the tips. Otherwise its characters are so typically those of this group that it could not be placed elsewhere. Kieffer has described a genus, *Folchinia*, from the mediterranean region which may be related, but unfortunately he gives no characters which allow of its being placed in any subfamily.

"I have a second species which is probably congeneric, but the antennae are broken off near the base. It was sent me, some years ago, by Dr. Hans Brauns, collected at Bothaville, Cape Colony."

Metaspathius apterus sp. nov.

"♀. Length 2 mm. Fusco-ferruginous, the gaster and tips of antennae piceous. Head above smooth and shining, highly convex and broadly rounded on the sides, with the eyes placed very far forward; above the eyes on the front are a few horizontal striae, and the very small ocellar space is indicated by minute hyaline points. Frontal projection that of Belytid, as broad as the width of the eye. Face shagreened, clypeus shining; palpi yellowish-white, slender. Eyes very small, nearly circular, bare, no wider than the thickness of the antennal scape. Scape two and one-half times as long as thick, pedicel small, globular; first flagellar joint as long as the width of the head; more than six times as long as thick; second and third each three-fourths as long as the preceding, following growing shorter, but each more than twice as long as thick; tip of flagellum as thick as the base. Prothorax above as long as the mesonotum, reticulate. Mesonotum areolate, but without parapsidal furrows. Propodeum convex above, reticulate or irregularly areolate; perpendicularly declivous behind. Pleurae shagreened, the underside of the thorax clothed with long whitish hair. Petiole of abdomen coarsely shagreened and with four longitudinal carinae, two above and one on each side at the level of the spiracle. Gaster smooth and highly polished, ovate, the second segment occupying more than one-half of the surface, before the tip with a transverse line of widely separated white hairs; following segments each with a similar line of hairs. Type from Nelson, New Zealand, December 8, 1921 (*A. Philpott*).

"At first glance this insect looks very much like a species of *Pezomachus*."

Pseudospathius jacobsoni Szepligeti.

Pseudospathius jacobsoni Szepligeti, 1908, *Notes Leiden Mus.* **29** : 222, ♀.

"Kopf vollkommen kubisch, matt; Scheitel flach und breit, hinten gebuchtet; Gesichtsmitte mit glänzendem Kiel. Fühler fadenförmig, länger als der Körper; Schaft eiförmig. Das erste Geisselglied viermal länger als breit und so lang wie das zweite. Thorax gestreckt, vorn und hinten verschmälert; Pronotum gross; Mesonotum glänzend, Parapsiden tief, schwach runzlig; Schildchen etwas konisch, Hinterschildchen mit Zahn. Mesopleuren glänzend, mit langer scharfer und schwach crenulierter Furche; Metanotum schwach glänzend, Ende runzlig; mit fünf, nach der Länge laufenden Kielen, der mittlere Kiel verkürzt; Luftloch klein. Randmal lanzettlich, mit gleich langen Seiten; Radialzelle erreicht fast die Flügelspitze; Endabschnitt der Radialader gerade und bildet mit der zweiten einen stumpfen Winkel; Grundader schief; Radialader des Hinterflügels undeutlich. Hüften an der Basis eckig, Schenkel kurz und dick. Hinterleib länger als Kopf und Thorax, nahe dem Ende zu spatelförmig erweitert, gerieft, zwischen den Riefen punktiert; das erste Segment dreimal länger als breit, fast parallel, mit zwei Kielen an der Mitte; das zweite quadratisch, halb so lang wie das erste; das dritte Segment quer und vor der feinen zweiten Sutur mit einer Querfurche; das letzte (sechste) Segment ist das grösste. Hypopygium ganz kurz. Beine abstehend und sparsam behaart.

"Schwarz; Fühler, Taster, Vorderbeine, Mittelbeine (die Schenkel ausgenommen), an den Hinterbeinen die Trochanteren, Basis und Mitte der Schienen und die Tarsen rot. Flügel hellbraun gefleckt, die hinteren hyalin.

"Länge 7 mm., Bohrer etwas länger als der halbe Hinterleib.

"Ein Exemplar.—In meiner Sammlung".

I do not think this species is a *Pseudospathius*; the details of the thorax and of the abdomen make any affinity with this genus seem unlikely. The insect is probably an aberrant *Rhaconotus* or may perhaps be regarded better as belonging to a related genus.

Spathius albiventris Szepligeti.

Spathius albiventris Szep., 1905, *Ann. hist.-nat. Mus. hung.* **3** : 41.

"♀. Kopf quer, Gesicht runzelig, Stirne und Scheitel gerieft, die Umgebung der Nebenaugen runzelig. Mesonotum grobrunzelig, Notaulen undeutlich; Mesopleuren an der Mitte matt, die Furche runzelig; Schilden lederartig und matt; Metapleuren glatt, etwas glänzend; Metanotum gefeldert, lederartig und matt, an der Mitte mit einer deutlichen aufrechtstehenden Schuppe. Die Seiten des Randmals gleich lang, N. recurrens an der zweiten Cubitalzelle inserirt, N. posticus interstitial. Hinterhüften quergerieft, an der Basis gestutzt, ohne eckiger Vorragung. Hinterleibsstiel fein runzelig, mit Längskielen, länger als der übrige glatte Hinterleibstheil und so lang wie der Thorax.

"Schwarz; Augenrand (mehr oder minder) und Squamula roth; die vier Vorderhüften, Trochanteren zum Theil, Schenkel der vier Vorderbeine, Spitze der Schienen und der Hinterhüften, Bauch, Taster und Schaft weiss. Flügel braun, Nerven und Randmal schwarz.

"Länge 5 mm., die Scheiden fast eben so lang und bräunlich.

"Neu-Guinea: Sattelberg (*Biró*)."

Location of type unknown to me.

Spathius antennalis Szepligeti.

Spathius antennalis Szep., 1905, *Ann. hist.-nat. Mus. hung.* **3** : 40.

"♀. Kopf quer, Gesicht beiderseits undeutlich querrunzelig, Stirne deutlich gerieft, Scheitel fast glatt. Mesonotum querrunzelig, tief getheilt; Schildchen glatt; Mesopleuren an der zwei grossen Felder an der Basis glatt. Innere Seite des Randmals länger als die äussere, N. recurrens an der zweiten Cubitalzelle inserirt, N. posticus fast interstitial. Hinterhüften an der Basis gestutzt, ohne eckiger Vorragung. Hinterleib glatt, der Stiel so lang wie der Thorax und an der Basalhälfte undeutlich längsrunzelig.

" Schwarz; Kopf, Mesonotum und Scutellum roth; Taster und Fühlerspitze (gebrochen) weiss; Beine und Hinterleibspitze gelbroth, Hüften weiss oder weisslich, Hintertarsen braun. Flügel gelblichgrau, etwas glänzend; Randmal und Nerven lichtbraun.

" Lange 3 mm.; Scheiden braun und länger als der Körper.

" Neu-Guinea : Simbang (*Biró*)."

Location of type unknown to me.

Spathius flavicornis Szepligeti.

Spathius flavicornis Szep., 1913, *Ann. hist.-nat. Mus. hung.* **11** : 599.

" Kopf glatt. Mesonotum fein runzlig, Parapsiden deutlich, Mittellappen vorstehend; Mesopleuren glatt, die Furche krenuliert; Metanotum runzlig, undeutlich gefeldert, Erstes Segment runzlig, reichlich dreimal länger als an der Spitze breit und länger als die Hälfte der folgenden Segmente zusammen; 2. und folgende Segmente glatt.

" Schwarz, Taster, Fühler (geringelt), Tegula und Beine gelbrot; Gesicht und Wangen rotbraun, Spitze des 1. Segmentes und des Hinterleibes rötlich. Flügel hellbraun, Randmal dunkel.

" Länge : 3 mm.; Bohrer so lang wie der Hinterleib ohne 1. Segment.

" Deutsch-OstAfrika : Arusha-Ju (Katona)."

Location of type unknown to me.

With its short ovipositor this species seems to be distinct from any other known to me from Africa.

Spathius flavofulvus nom. n.

Spathius testaceus Szep., 1913, *Ann. hist.-nat. Mus. hung.* **11** : 600 (*nec* Szepligeti, 1902).

" Dem *Spathius caudatus* ähnlich, nur Thorax vorn feiner gerunzelt. Gelbrot; Fühler braun, Basis gelbrot und vor dem Ende weiss; Hintertarsen bräunlich; Flügel leicht getrübt, Randmal gelb.

" Länge 5 mm.; Bohrer länger als der Körper.

" Deutsch-Ostafrika : Moshi (Katona)."

Location of type unknown to me.

This species may be only *laeviceps* Brues. The original name is a homonym of *Spathius testaceus* Szepligeti, 1902.

Spathius fulvus Szepligeti.

Spathius fulvus Szep., 1905, *Ann. hist.-nat. Mus. hung.* **3** : 42.

" ♀. Kopf rundlich, Gesicht behaart und runzelig, Stirne und Scheitel sehr fein gerieft. Hinterkopf leicht gebuchtet. Fühler länger als der Körper. Mesonotum querrunzelig. Notaulen ausgebildet. Mesopleuren fast glatt, mit Furche. Schildchen glatt. Metanotum gefeldert, einige Felder querrunzelig, die übrigen glatt. Die Seiten des Randmals gleich lang, N. recurrens an der zweiten Cubitalzelle inserirt, n. posticus fast interstitial. Hinterhüften an der Basis gestutzt. Hinterleib glatt, der Stiel undeutlich längsrunzelig und fast so lang wie die übrigen Segmente zusammen.

"Thorax braunroth. Kopf und Hinterleib braungelb, Beine lichter, Flagellum braun. Flügel gelblich hyalin, Randmal und Nerven braun.

"Länge 3 mm., Bohrer ebenso lang.

"Neu-Guinea: Simbang (*Biró*)."

Location of type unknown to me.

Spathius fuscipennis Ashmead ♂.

Spathius fuscipennis Ashmead, 1906, *Proc. U.S. Nat. Mus.* **29** : 119.

"Length 3 mm. Head, mesothorax, and scutellum reddish-brown, the rest of the thorax and the abdomen black, or the latter is very dark castaneous; the antennae are very long and slender, about twice as long as the whole body, fuscous, except the five or six basal joints, which are yellowish; the legs, or at least the anterior pair (the middle and hind pairs being broken off), are pale yellowish. The mesonotum is shagreened, more or less rugulose posteriorly in front of the scutellum, the latter has a crenulate furrow across its base; the metathorax is rugulose and areolated; the abdomen is very longly petiolated, the petiole being very slender, nearly as long as the thorax, very delicately longitudinally aciculated at the sides, and wrinkled or shagreened above; the body of the abdomen is nearly pear-shaped, concave beneath, and smooth and highly polished.

"Type.—Cat. No. 8457, U.S.N.M.

"Manila. (Father Robert Brown)."

Spathius javanicus Szépligeti.

Spathius javanicus Szepligeti, 1907–08, *Notes Leyden Mus.* **29** : 220, ♂.

"Kopf rundlich; Scheitel glatt, Gesicht runzlig, mit einem deutlichen Kiel. Mesonotum runzlig, vorne sanft abfallend und nicht senkrecht gestutzt. Metanotum gefeldert, an der Seite runzlig und area centralis gerieft. Der rücklaufende Nerv an die zweite Cubitalzelle inseriert; Radialader des Hinterflügels sehr undeutlich. Erstes Segment fein runzlig, an der Seite gerieft, kürzer als der Thorax und kürzer als der übrige Hinterleibsteil; das zweite Segment sehr fein gerieft und 1½ mal länger als das dritte.

"Schwarz; Kopf, Mesonotum und das zweite Segment rötlich; Beine gelb, Hüften, Schenkel und Tarsen der Hinterbeine rotbraun. Flügel gelblich-hyalin, Wurzel weiss; Randmal braun.

"Länge 3 mm.

"JAVA.

"1 Exemplar.—In meiner Sammlung."

Spathius manni Brues.

Spathius manni Brues, 1918, *Bull. Mus. Comp. Zool. Harv.* **62** (3) : 102.

"*Type.*—M.C.Z. 9,053. Solomons: Wai-ai. W. M. Mann.

"♀. Length 7·5 mm., ovipositor 3 mm. Black; head below the level of the antennae dark reddish-brown; antennae yellowish at base, brown beyond: palpi piceous; tarsi brownish-yellow; posttegulae white, seventh and eighth segments of abdomen yellow; wings fuscous, with a hyaline cross-band near the base and a hyaline streak extending across from the base of the stigma; apex hyaline; veins black, stigma white at base. Head seen from above, as wide as thick, full behind the eyes, then roundly narrowed to the prominent posterior carina; eyes rather large, as wide as the cheeks, the malar space two-thirds the length of the third antennal joint; eyes slightly emarginate opposite the antennae; ocelli in a nearly equilateral triangle, posterior ones nearer to one another than to the eye-margin. Mouth opening gently concave above, the clypeus separated, with deep lateral foveae. Face transversely rugose; front and vertex evenly transversely aciculate; back of head above middle of eyes horizontally aciculate, the aciculations curving upwards to meet those of the vertex; cheeks smooth. Antennae slightly longer than the body, flagellar joints regularly decreasing in length; first one-fourth longer than the second; maxillary palpi nearly twice the length of the head. Prothorax with the posterior margin strongly carinate. Thorax long and narrow; mesonotum slightly longer than the propodeum and one-half longer than wide, its surface shagreened; parapsidal furrows deep; coalescing at the middle to form a transversely areolate depression. Scutellum with six small elongate pits at the base, its surface shagreened. Propodeum transversely rugose-reticulate; with a median carina that forks just before the middle to form a long petiolar area extending to beyond the middle; spiracle small, circular; below it a complete carina with an incomplete one below that. Pro- and mesopleura irregularly striate and reticulate, the mesopleura with a shagreened area at the middle below. Petiole of abdomen as long as the thorax from posterior angle of propleura to tip of propodeum; slender, scarcely bent, slightly widened at the spiracles and again after posterior fourth, the apex twice as wide as at the spiracles which are at basal third; its surface rugose medially, striate-reticulate on the sides, more finely striate toward apex. Second segment microscopically transversely aciculate, more distinctly so at base, as long as wide at apex which is twice as wide as base; third to fifth minutely roughened with a polished band at base; sixth polished; seventh longitudinally striate on basal half. Legs comparatively slender; hind coxae finely shagreened above, their femora four times as long as thick. Front tibiae finely spinulose on their anterior surface; middle ones minutely denticulate; hind ones minutely tuberculate on hind edge. Submedian cell slightly longer than the median, recurrent nervure received at base of second cubital cell; subdiscoidal vein interstitial.

"This species is quite distinct in size and colour from any others known from the Indo-Malayan region."

Probably belongs to group of *ruficeps*.

Spathius melleus Brues.

Spathius melleus Brues, 1918, *Bull. Mus. Comp. Zool. Harv.* **62** (3) : 103.

"*Type.*—M.C.Z. 9,054. Solomons: Rio. W. M. Mann.

"♀. Length 2·7 mm., ovipositor 1 mm. Honey-yellow, the thorax somewhat darker than the head, abdomen, and legs; antennae blackened beyond middle; wings yellowish hyaline, with a faint cloud just before and another just beyond the middle. Head as broad as thick, scarcely widened behind the eyes, hind margin strongly carinate. Eyes a little longer than wide, slightly broader than the cheeks. Anterior margin of clypeus strongly concave; face shining, with rather faint irregular sculpture and a median elevation from the clypeus to the base of the antennae; malar space nearly as long as the third antennal joint; front below the ocelli weakly arcuately aciculate; ocelli in a nearly equilateral triangle, posterior pair almost twice as far from one another as from the eye-margin; head above ocelli highly polished, faintly coarsely shagreened; head behind smooth and polished. Antennae with the joints of the flagellum gradually growing shorter, the second scarcely shorter than the first. Pronotum with a strong transverse carina, just behind the raised anterior margin and with a weaker one at the middle. Mesonotum short, no longer than wide, coarsely shagreened; parapsidal furrows complete, bounded interiorly on their posterior half by a raised line, the space between not reticulate. Scutellum with a deep crenate groove at base. Propodeum areolated as in *S. manni*, but with the superomedian and petiolar areas separated and the surface more coarsely sculptured and more shining. Petiole of abdomen stout, considerably curved above, as long as the propodeum to the root of the hind-wing, evenly widened from base to apex where it is less than twice as wide as at spiracles; coarsely striate above and on the sides. Second segment with a row of short longitudinal striae at base, followed by an area of very faintly impressed large punctures; apex polished. Following segments smooth, polished. Propleura irregularly reticulate; mesopleura shagreened, with a small reticulate space in front above. Legs stout; hind coxae shagreened, their femora three times as long as thick; none of the tibiae with denticles or tubercles. Recurrent nervure received near the base of the second cubital cell: submedian cell barely longer than the median; subdiscoidal vein interstitial.

"This species is somewhat similar in size and colour to the Papuan *S. minutus* Szep., but lighter, with the metathorax not black; the mesothorax shows no transverse sculpture and the head is entirely smooth."

The sculpture of the tergite (2 + 3) suggests that this species is different from any described in this monograph.

Spathius minutus Szepligeti.

Spathius minutus Szep., 1900, *Természetr. Füz.* **23** : 55.

"♂. Kopf rundlich, glatt. Fühler sehr fein, länger als der Körper. Mesonotum drei lappig, fein etwas querrunzlig; Metanotum gefeldert. Nervus recurrens deutlich an die zweite Cubitalzelle inserirt. Erstes Segment runzlig, länger als der übrige ovale, glatte Hinterleib. Hinterschenkel kurz, dick.

"Kopf, Pro- und Mesothorax, roth; Taster, Schaft und Füsse gelb; Hinterschenkel, besonders an der Mitte, rothbraun; Metanotum Schwarz; Flagellum und Hinterleib braun, ins Röthliche übergehend. Stigma braun. Länge 2 mm.

"Friedrich-Wilhelmshafen, 1896, Ein Exemplar (*Biró*)."

This may be a member of the group of *alipes* Wilkinson, but it cannot be recognised from the above description.

Location of type unknown to me.

Spathius pedunculatus Cameron.

Spathius pedunculatus Cam., 1910, *Wien. ent. Ztg* **29** : 93.

"Black, the head (the face is blackish), mandibles, except at the apex, antennae, the apical half of scutellum in the centre (the mark almost square) and the greater part of the scutellum, rufo-testaceous, the base of the 2nd abdominal segment, its apex and the apices of the others, of a paler rufo-testaceous colour, as are also the 2nd and following ventral segments; legs yellowish testaceous, the apex of the hind femora broadly infuscated; wings hyaline, the stigma for the greater part testaceous, the nervures blackish. ♀.

"Length nearly 5 mm.; terebra nearly 2 mm., as long as the abdomen. 'Java, Hoffgg. S.' 12802. The specimen bears the name of '*Spathius pedunculatus*, Hoffgg.', but the species has never been described.

"Face irregularly, somewhat strongly transversely striated, sparsely covered with longish black pubescence. Clypeus smooth, depressed, clearly separated. Front and vertex transversely rugosely punctured, the front more strongly than the vertex and more distinctly striated. Middle lobe of mesonotum finely, more or less transversely striated, the lateral much more strongly striated, the basal half more strongly than the apical and the striae there are more or less curved. Scutellum finely punctured. Metanotum with areae; the basal much smaller than the apical, the central triangular, the lateral squarish; the central apical is slightly narrowed in the middle; the outer are widened in the centre on the outer side, where the keel projects into a tooth; all the areae are more or less strongly transversely striated. Upper part of propleurae longitudinally striated at the apex, the rest with stouter striae running from above downwards and curved on the top.

Upper third of mesopleurae strongly, regularly, longitudinally striated; the base and apex more finely and irregularly, the metapleurae strongly obliquely, closely striated and divided into two by a longitudinal keel. Abdominal petiole opaque, finely closely longitudinally striated, two-thirds of the length of the rest of the abdomen; it is bare, but this is probably through the pubescence being rubbed off. 2nd abdominal segment as long as the others united. As usual the legs are covered with stiff pale hairs. The antennae are covered with stiff pale hair. The recurrent nervure is received in the 2nd cubital cellule; the transverse median nervure is received beyond the transverse basal; 3rd abscissa of radius twice the length of basal 2 united."

Type in Zoological Museum, Berlin.

Spathius pellitus Enderlein.

Spathius pellitus Enderlein, 1912, *Arch. Naturgesch.* **78** (A2) : 5.

"♀. Gesicht und Stirn mit feinen Querritzen. Scheitel und die ziemlich langen Schläfen poliert glatt. Wangen etwas rauh. Fühler länger als der Körper, mehr als 30 gliedrig, die Geisselglieder schlank, etwa fünfmal so lang wie dick, das 1. Geisselglied viel länger. Palpen schlank.

"Mesonotum matt, Parapsidenfurchen scharf mit scharfer Querriefung. Scutellum klein, flach, poliert glatt und gerandet, Quergrube davor mit 5 kurzen Längsleistchen. Propleure mit Querleistchen, Mesopleure poliert glatt. Metapleure mit dem Mittelsegment verschmolzen, mit dichten, stellenweise etwas genetzten Querleisten. Mittelsegment mit einigen grossen Netzmaschen, dazwischen teilweise unregelmässig gerunzelt; Area centralis fünfeckig, vorn gestielt. Hinterleibstiel rauh punktiert längsgerieft, etwas gekrümmt. Abdomen glatt. Beine mit langer, wenig dichter abstehender Behaarung. Schenkel in der Endhälfte keulig verdickt.

"Basalhälfte des Vorderflügelvorderrandes lang behaart. Der erste Radialabschnitt halb so lang wie die 1. Cubitalquerader, 2. Radialabschnitt 1½ der 2. Cubitalquerader. 2. Cubitalzelle fünfseitig, etwas kürzer als die dritte. Radius des Hinterflügels fast völlig verblasst. Stigma mässig breit.

"Kopf rostfarben. Ocellenbasis schwarz. Fühler rostgelb, Endhälfte braun, Spitzenachtel hell rostgelb, Spitzen der Geisselglieder der Basalhälfte braun. Thorax, Mittelsegment und Abdominalstiel schwarz, Mesonotum mit Scutellum rostfarben. Abdomen rostfarben, ebenso Legerohr; Scheiden mit brauner Endhälfte. Beine blassgelb, Endhälfte der Hinterschenkel rostbraun. Flügel hyalin, mit schwach rostgelbem Ton. Stigma braun, Basaldrittel gelblichweiss; am Scheitel ein aufsitzender brauner Fleck. Adern rostfarben.

"Korperlänge 5·6 mm., Vorderflügellänge 4 mm., Fühlerlänge etwa 6·5 mm., Länge des Abdominalstieles 1 mm., Länge des Legerohres 2·4 mm.

"*Sumatra.* Soekaranda. 1 ♀. Dr. H. Dohrn. Type im Stettiner Zoologischen Museum."

Spathius philippinensis Ashmead. ♀.

Spathius philippinensis Ashmead, 1905, *Proc. U.S. nat. Mus.* **28** : 148.

"Length, 2·6 mm.; ovipositor about two-thirds the length of the abdomen. Black; the middle mesothoracic lobe, the cheeks, the apical third of the petiole of the abdomen, and most of the legs are reddish-brown; the tarsi, except last joint, whitish; the hind tibiae, dark fuscous; the antennae are very long and slender, much longer than the body, yellowish, but becoming dusky or brown at apex. Wings subfuscous, with the extreme tips, a transverse band at basal third, and another at the apical third, hyaline or whitish; the second band on the wings starts from and includes the basal half of the stigma.

"*Type.*—Cat. No. 8010, U.S.N.M.
"Manila. (W. A. Stanton)."

Spathius pilosus Szepligeti.

Spathius pilosus Szep., 1910, *Notes Leyden Mus.* **32** : 86, ♀.

"Scheitel fein gerieft, Gesicht runzlig. Mesonotum fein runzlig. Parapsiden breit, Mittellappen vorstehend, mit Furche; Pleuren und Metanotum runzlig, die mittlere Längsleiste am Ende undeutlich. Innere Seite des Randmals kürzer, Radialader der Hinterflügel deutlich. Beine zerstreut und abstehend behaart. Erstes Segment runzlig, kürzer als der Thorax und so lang wie die folgenden Segmente zusammen; zweites Segment sehr fein lederartig, halb so lang wie das 1.; das 3. Segment etwas kürzer als die Hälfte des 2. Segmentes.

"Schwarz; Taster, Schaft (Flagellum fehlt), Vorder- und Mittelhüften, Spitze der Hinterhüften und Basalteil der Trochanteren weiss; Kopf, Vorderbeine und 1. Segment braunrot. Flügel braun, mit zwei schmalen und hyalinen Querbändern; Flügelwurzel und Basis des Randmals weiss.

"Länge 5, Bohrer 3·5 mm.

"Batavia.—1 Exemplar."
Type presumably in Coll. Szepligeti.

Spathius polonicus Niezabitowski.

Spathius polonicus Niez., 1909, *Mat. Faun. Brak. Polk.* : 23, ♀.

"Caput subcubicum, 0·57 mm. longum, 0·76 mm. latum, rufotestaceum, totum fortiter transverse striatum; clypeus triangularis, marginatus; facies en medio longitudinaliter convexa; antennae 36 articulatae, 4·56 mm. longae, dimidius basali luteo, deinde nigricantes; mandibulae testaceae, apicae nigrae; palpi nigri, maxillares elongati: thorax elongatus, 1·71 mm. longus, 0·76 mm. latus, niger, punctulatus, pronoto subtus, mesonotu, lobo medio antice, testaceo; pronotum transverse striatum; notauli distincti. Spatium latum antescutellare rugosum, carinis duabus sinuosis longitudinalibus instructum; scutellum dense punctatum, fossa antescutellaris late crenata; metathorax ruguloso reticulatus, carinis acutis in areolae profundas discretus; pleurae nitidae, fossa longitudinali alta, angusta, marginibus striatis. Alae nigricantes alae superior macula parva in basi cellulae 1-ae medianae, fascia lata transversa per medium cellulae costalis et medianae cunti, macula parva cellulae 1-ae discoidalis, fascia transversa alae a basi stigmatis, macula ovali cellulae radialis ante apicem stigmatis, limbo lato apicali alae lituraque hyalina nervum 2-um transverso cubitalem anguste cingenti, hyalinis. Pedes rufo-testacei ultimo tarsorum articulo nigro; tibiae crasse punctatae, calcari apicali ad modum crasso brevi. Abdomen punctulatum, nigrum, segmento 1 basi rufo-testaceo; segmentum 1-um 0·86 mm. longum basi, 0·21, ad tubercula 0·27, apice 0·55 mm. latum, longitudinaliter punctato-striatum summa parte apicali media triangulari levi; tubercula a basi segmenti 1-o 0·27 mm. remota; terebra 2·51 mm. longa, nigra, recta.

"Nowy Targ. 2 Oczerwca."
Location of type unknown to me.

Spathius radialis Szépligeti.

Spathius radialis Szépligeti, 1907–08, *Notes Leyden Mus.* **29** : 221. ♀.

"Kopf rundlich; Scheitel glatt, Gesicht undeutlich querrunzlig. Mesonotum runzlig, Parapsiden deutlich, Mittellappen fast senkrecht gestutzt. Metanotum gefeldert, das Centralfeld fast glatt, Metapleuren runzlig. Radialader der Hinterflügel deutlich.

Rücklaufender Nerv an die zweite Cubitalzelle inseriert. Erstes Hinterleibssegment so lang wie der Thorax und etwas kürzer als der glatte übrige Hinterleibsteil, schwach runzlig, das Ende seitlich gerandet; das zweite Segment doppelt länger als das dritte.

"Schwarz; Kopf, Schaft und Beine gelbrot, die hintersten Schenkel dünkler; Mesonotum und Schildchen rot; Hinterrand des zweiten Segmentes und das Endsegment gelblich. Flagellum fehlt. Flügel hyalin, Randmal braun.

"Länge 3 mm., Bohrer 6 mm.

"JAVA.

"1 Exemplar. In meiner Sammlung.

"Das ähnliche *Sp. minutus* m. unterscheidet sich durch das längere erste Hinterleibssegment (länger als der übrige Hinterleibsteil) und durch die fehlende Radialader des Hinterflügels."

Spathius radzayanus Ratzeburg.

Spathius radzayanus Ratz., 1848, *Ich. d. Forstins.* **2** : 43.

"1¾ (♂)–2‴ (♀) lang. Dem vorigen (*S. curvicaudis* Ratz.) ausserordentlich ähnlich, jedoch, abgesehen von der etwas geringeren Grösse, durch die Sculptur bestimmt verschieden: Die Runzeln des Kopfes sind nicht so stark, und fehlen an den stark glänzenden Backen und dem Scheitel gänzlich (bei *curvicaudis* sind sie auch hier vorhanden). Auch sind die Fühler kaum so lang wie der Körper, und die Hinterschenkel nicht ganz so stark gedrungen. Flügel und Bohrer sind in Form und Farben merkwürdiger Weise ganz übereinstimmend. Das Schwarz herrscht hier bei Weitem mehr, als bei irgend einer bekannten Art; nur der Kopf zieht, namentlich in der Gegend der Mundtheile, etwas ins Bräunliche, und an den Beinen sind die Schenkelspitzen, Schienenbasen und Tarsen, meist auch die Hüften, Schenkelhöcker und Apophysen schmutzig-hellbraun, zuweilen auch der hintere Theil des Metathorax. Die Fühler sind ebenfalls heller, gegen die Spitzen etwas dunkler, die Glieder an der Spitze schwarz geringelt."

Germany, probably Silesia.

According to Ratzeburg, this species was bred by a certain Herr Radzay from oaks in which *Curculio* (now *Gastrocercus*) *depressirostris* F., *Buprestis biguttata* F. and several *Clytus* species were living. The cocoons of the parasite were in the form of an elongate barrel, pale pinkish-red and lay fastened together in groups of from two to six among the wood-detritus left by the host larva. Also bred by Ratzeburg himself from *Cerambyx indagator*.

Spathius rufotestaceus Motsch. ♂.

Spathius rufotestaceus Motsch., 1863, *Bull. Soc. Nat. Moscou.* **36** (2) : 31.

"Elongatus, subdepressus, punctatus, nitidus, rufotestaceus, antennis (basi excepta), puncto occipitali, metanoto petioloque nigro-fuscis, abdominis apice infuscato, oculis magnis, subrotundatis, prominulis nigris; capite rotundato, vertice densissime transversim striguloso, fronte convexa, glabra, ocellis distinctis in puncto nigro positis; antennis corpore vix brevioribus, brevissime pilosis, articulo 1-o magno, incrassato, clavato, 2-o breve, subtransverso, sequentibus angustatis, elongatis, fere aequalibus; thorace subopaco, elongato-subovato, antice subconico, postice truncato, pronoto antice strigulose-punctato, postice impresso, cicatricoso-rugoso, mesonoto glabro, marginato, metanoto rugoso, quadratim carinulato; alarum venis piceis, stigmate fusco; petiolo rugoso, supra longitudinaliter bisulcato, medio concavo-angustato; abdomine elongato-ovato, nitido, antice longitudinaliter striguloso, postice glabro, apice subtruncato, segmento 1-o angustato, valde elongato, sulcato; pedibus gracilibus, sparsim pilosis.

"Long. 1½ l.–lat. cap. ⅓ l.

"Des Montagnes de Nura-Ellia." CEYLON.
Location of type unknown to me.

Spathius solox Enderlein.

Spathius solox Enderlein, 1912, *Arch. Naturgesch.* **78** (A2) : 5.

"♀. Gesicht rauh, ziemlich dicht runzlig quergerieft. Stirn mit Spuren von Querritzung. Scheitel länger als die Augenlänge, gewölbt, poliert glatt. Schläfen breit, poliert glatt. Kopf hinter den Augen nicht verschmälert. Wangen rauh, fein punktiert. Fühler dunn, länger als der Körper; mehr als 42-gliedrig; Geisselglieder schlank, 3–4 mal so lang wie dick, die ersten länger.

"Thorax ziemlich glatt, Parapsidenfurchen scharf mit dichten kurzen Querriefen. Scutellum flach, dreieckig, poliert glatt. Propleure fein längsgeritzt. Mesopleure poliert glatt, vorn etwas längsgeritzt. Metapleure glatt, hinten und am oberen Rand quergerunzelt, vom Mittelsegment durch eine ziemlich scharfe Längsleiste getrennt. Mittelsegment vorn poliert glatt, hintere Hälfte querrunzelig; mit weiten Maschen genetzt, Area zentralis schlank fünfeckig, vorn lang gestielt. Abdominalstiel lang, fein unregelmässig querrunzlig, oben mit 2 Längsleisten, die hinten undeutlich werden, ganz am Ende ziemlich stark verbreitert; Behaarung wenig dicht, lang und abstehend. Das übrige Abdomen lang oval, matt, dorsoventral abgeflacht. 2. Tergit (Stiel mitgezählt) 1⅓ der übrigen zusammen. Legerohr lang. Beine mit langer abstehender Behaarung, Schenkel keulig verdickt. Kopf und Thorax mit ähnlicher Behaarung.

"Flugel schlank. 2. Cubitalzelle spitz viereckig, etwas länger als die dritte. 1. Cubitalquerader kaum doppelt so lang wie der 1. Radialabschnitt. 2. Cubitalquerader halb so lang wie der 2. Radialabschnitt. Stigma schmal und lang. Radius des Hinterflügels sehr blass.

"Kopf tiefschwarz. Fühler hell rostgelb, Spitzen der Geisselgliedier grau, die beiden Basalglieder gelb. Palpus schlank, sehr blass. Thorax, Tegulae und Abdomen schwarz. Coxen und 1. Trochanter gelb, die der Hinterbeine schwarz. 2. Trochanter, Schenkel und Schienen schwarz. Tarsen rostgelb. Legerohr hell rostgelb, Spitze braun. Flügel hyalin mit blass braünlichgelbem Ton. Pterostigma braun, Adern gelbbraun.

"Körperlänge 8 mm., Vorderflügellänge 5¾ mm., Fühlerlänge etwa 10 mm., Länge des Abdominalstieles 2·3 mm., Länge des Legerohres 8 mm.

"SUMATRA. Soekaranda. 1 ♀. Dr. H. Dohrn. Type im Stettiner Zoologischen Museum."

Spathius solox Enderlein, var. *rufescens* Enderlein.

Spathius solox Enderlein, 1912, *Arch. Naturgesch.* **78** (A2) : 6.

"Rostrot ist Mittelsegment, Basalhälfte des Abdomen und Hintercoxen. Schenkel mit Schienen hell rostbraun. Sonst wie die Stammform. Körperlänge 9 mm., Vorderflügellänge 6¾ mm., Länge des Abdominalstieles 2·5 mm., Länge des Legerohres 9 mm.

"SUMATRA. Soekaranda. 1 ♀. Dr. H. Dohrn. Type im Stettiner Zoologischen Museum."

Spathius strandi Fahringer. ♀.

Spathius Strandi Fahringer, 1930, *Opusc. bracon.* **3** : 82.

"Kopf fast kubisch, hinten fein gerandet. Stirn hinter den Fühlern eingedrückt und dort querrunzelig. Scheitel, Hinterkopf und Schläfen sonst glatt. Fühler mehr als 40 gliedrig, lang und schlank. Schaft fast eiförmig, die einzelnen Geisselglieder cylindrisch, viel länger als breit. Gesicht und Wangen fein querrunzelig. Thorax lederartig runzelig,

Schildchen glatt. Prothorax und Mesopleuren unter dem Tegulae kräftig gerünzelt, der übrige Teil fast glatt mit einer kurzen Querfurche. Metapleuren fast ganz runzelig. Mediansegment grobrunzelig und gefeldert. Area superomedia klein, und weit nach hinten gelagert. Hinterleibsstiel (1. Tergit) 4 mal länger als breit und kräftig längsgestreift, von etwas mehr ⅓ der Länge der übrigen Tergite zusammen. Der übrige Hinterleib keulenförmig, unten etwas kompress. 2. Tergit überaus fein chagriniert, die folgenden Tergite glatt. Bauch vorne gekielt. Bohrer fast von Körperlänge. Länge 7–8 mm.

" Hellrötlichbraun, Augen, Pro- und Mesothorax schwarz, die Mesopleuren z. T. hell. Fühler und Beine bräunlich, die letzteren lichter. Flügel leicht graulich getrübt. Stigma schwarz mit gelber Basishälfte, die unter der äusseren Hälfte des Stigma befindlichen Teile der Zellen sind z. T. verdunkelt. Diese grosse Art steht, was Bohrerlänge anbelangt, dem *Sp. exarator* L. am nächsten, durch den kurzeren Hinterleibsstiel, die dunklere Färbung am Thorax und die Sculptur des Thorax, bzw. Hinterleib, ebenso auch durch dessen Form bestimmt verschieden.

" Im Wiener Museum 3 ♀ aus der Wiener Gegend (leg. Frauenfeld).
" Herrn Professor Embrik Strand in Riga gewidmet."

Spathius testaceus Szépligeti. ♂.

Spathius testaceus Szépligeti, 1902, *Természetr. Füz.* **25** : 50.

" Kopf glatt, Thorax punktirt, Notaulen ausgebildet, Metanotum gefeldert; erstes Hinterleibssegment so lang wie die übrigen Segmente zusammen, leicht gebogen, gleich breit und undeutlich längsrunzlig. Nervus recurrens an die zweite Cubitalzelle inserirt, Brachialzelle geschlossen, Nervus parallelus fast interstitial. Fünftes Tarsenglied gross, so lang wie die zwei vorhergehenden zusammen.

" Gelbroth; Taster, Coxen Schenkel- und Schienenbasis weiss, Flügel fast ganz hyalin, Stigma mit grossem schwarzen Fleck, Basalader schwarz.—Länge 2 mm.

" Neu-Guinea : Sattelberg. Gesammelt von L. Biró."
Type presumably in the National Museum, Hungary.

Spathius trichiosomus Cameron.

Spathius trichiosomus Cameron, 1910, *Tijdschr. Ent.* **53** : 45.

" Rufous, the head black, tinged with brown, the 2nd and following segments of the abdomen black; the antennae yellowish-testaceous; the legs rufo-testaceous, the coxae, trochanters and the greater part of the femora black; wings hyaline, the middle clouded with fuscous, the nervures and stigma fuscous, the latter white at the base. ♀.

" Length : 10 mm.; terebra 8 mm.

" Ceylon (Nietner).

" Pubescence long, sparse, erect, white. Front and vertex closely, distinctly but not very strongly transversely striated; the temples longitudinally striated; the malar space smooth. Face rugosely transversely striated; the striae stronger and more distinctly separated on the sides below. Antennae almost bare. Temples broadly rounded, longer than the eyes; the occiput broadly roundly incised. Pronotum transversely, the pleurae longitudinally striated, the striae on the former rounded. Mesonotum trilobate, the base of the middle lobe finely, the lateral lobes more strongly rugosely punctured; the depression between the lateral lobes stoutly transversely striated, the striated part bordered near the outer edge by a longitudinal keel. Scutellum very finely closely transversely striated. Metanotum with the central part transversely striated, the striae stronger on the outer sides; there is an irregular keel down the middle, bifurcated at the centre. Metapleurae strongly, closely obliquely striated, the lower part rugosely punctured. Propleurae strongly longitudinally striated; the mesopleurae strongly striated at the base and below, the centre almost smooth. Abdominal petiole slender, of uniform thickness, except that the base is slightly dilated behind the spiracles; it is about three-fourths of the length of the thorax and, if anything, longer than the rest of the abdomen. Apical abscissa of radius longer than the basal 2 united. The 1st transverse cubital nervure is slightly bent behind; it is as long as the 2nd abscissa of the radius.

" The dilated apical part of the abdomen forms an elongated oval; it is wider than the thorax. Head large, cubical."

Type presumably in Zoological Museum, Berlin.

Spathius tutuilensis Fullaway.

Spathius tutuilensis Fullaway, 1940, *Proc. Hawaii. Ent. Soc.* **10** (3) : 404.

" *Female and male.*—4 mm. long; ochreous brown, shining, the head infuscate above; legs and antennae stramineous; wings densely clothed and beclouded with whitish hairs, chalky or milky white in appearance. Head a little wider than the thorax, wider than long, extended somewhat behind the eyes, which are short, oval, convex, bare; ocelli arranged in a small equilateral triangle on summit of vertex, distance between members considerably less than to margin of eye, fronto-vertex convex above, declivous in front of ocelli, smoothly rounded on to occiput, which has margin strongly carinate, all smooth, polished and shining; face lying in vertical plane, wider than long, finely aciculate and sparsely punctate; clypeus small, distinctly separated, anterior margin carinate and slightly curved; mandibles below oral orifice, short, stout, bidentate, pointed apically, basal width hardly as great as the length of the malar space; antennae attached at middle distance of eyes behind a frontal prominence, the sockets oval, fairly far and wide apart, rather close to eye-margin, with a deep groove or depression between, longer than the body, consisting of 34 segments, which get gradually shorter outwardly although there is not much difference in the lengths of the first four segments, segments 1 and 2 are stout, the flagellum very slender; maxillary palpi 5-segmented, long, slender; labial palpi 3-segmented, short, a little thicker; genae and post-genae quite wide; the labrum, face and vertex sparsely hairy. Prothorax prominent with the anterior and posterior margins strongly carinate, the saddle rather coarsely reticulately sculptured; mesoscutum longer than wide, convex, its surface shagreened, parapsidal furrows deep; scutellum triangular with a wide and deep costate furrow at base, surface smooth and shining; metanotum a transverse furrow with posterior margin strongly carinate; propodeum as long as mesoscutum, convex, rugulose, areolated, the areola triangular in outline with apex at anterior margin; spiracles circular; mesopleura smooth and shining with a conspicuous pit in centre of disc. Abdomen elongate oval, petiolate, the petiole nearly half its length, rather slender, somewhat expanded apically and slightly convex upward, rugulose, spiracles at about the middle slightly raised, abdominal segments beyond petiole smooth, polished, transverse, the 2nd however nearl as long as wide; ovipositor nearly as long as the abdomen exclusive of petiole. Legs fairly stout, spinulose, hind coxae shagreened above. Wings rather long and narrow, the stigma large, lanceolate, recurrent nervure received at base of 2nd cubital cell, which is long and narrow, only about half as wide at base as it is apically, nervulus slightly postfurcal, radius reaching apical margin of wing.

" Described from three female and three male specimens collected on Tutuila, Samoan Islands, by D. T. Fullaway, as follows: 2 females and one male from Amouli, captured in February, 1930 (type, allotype and paratype); 1 female from Vatia Trail, captured in February 1930; one male from Fagasa, captured on March 8th, 1930; one male from Leone-Aule Trail, captured on February

12th, 1930 (paratypes). An odd female collected by Swezey and Wilder 9/7/23 on the Leone Road off a taro plant is the same species."

Type presumably in the Bishop Museum, Honolulu.

Spathius variipes Szepligeti.

Spathius variipes Szep., 1905, *Ann. hist.-nat. Mus. hung.* **3** : 41.

" ♀. Kopf fast kubisch, hinter den Augen glatt; Gesicht runzelig. Stirn flach, Scheitel fein gerieft, Hinterkopf glatt und kaum gebuchtet. Thorax grobrunzelig. Parapsiden vorne ziemlich deutlich und breit; Mesopleuren mit etlichen Querrunzeln, die Furche breit und seicht; die beiden Mittelkielen am Ende des Metanotums fehlen. Flügel und Beine wie bei der vorgehenden Art (*albiventris* Sz.). Hinterleib glatt, der Stiel länger als die übrigen Segmente zusammen, mit feinen Längsleisten und glänzend.

" Schwarz; Schaft, die vier Vorderbeine und Hinterhüften weiss, schwarz gefleckt; Hinterleib vom zweiten Segment an roth, oben geschwärzt. Flügel braun.

" Länge 8 mm., Bohrer eben so lang.

" NEU-GUINEA : Friedrich-Wilhelmshafen (*Biró*)."

Location of type unknown to me.

Spathius minutissimus Szépligeti.

Spathius minutissimus Szépligeti, 1907–08, *Notes Leyden Mus.* **29**: 221. ♀.

" Kopf rundlich, glatt, Mesonotum runzlig, vorn gerundet abfallend, Parapsiden deutlich; Metanotum matt, gefeldert. Randmal mit gleich langen Seiten; rücklaufender Nerv an die innerste Ecke der zweiten Cubitalzelle inseriert, nervus parallelus interstitial. Erstes Segment gerieft-runzlig, bedeutend kürzer als der Thorax und so lang wie das glatte zweite Segment, dieses so lang wie die folgenden Segmente zusammen.

" Gelb, Hüften weisslich. Flügel hyalin, mit einigen wolkig getrübten Stellen; Rand mal braun, mit weisser Basis. Fühler schwarz geringelt.

" Länge 1·5 mm., Bohrer $\frac{2}{3}$ des Hinterleibes.

" JAVA.

" 1 Exemplar.—In meiner Sammlung."

Stenophasmus annuliventris Enderlein.

Stenophasmus annuliventris Enderlein, 1912, *Arch. Naturgesch.* **78** (A2) : 11–12.

" ♀. Gesicht glatt und matt. Stirn mit Ausnahme der Seitenränder mit mikroskopisch feiner dichter Querriefung. Der übrige Kopf glatt. Hinterhauptsrand scharf. Ocellen klein und zu sehr kleinem Dreieck angeordnet. Fuhler mässig dünn, langer als der Körper, Geisselglieder mässig lang, etwa 3 bis 4 mal so lang wie dick; 32 Fühlerglieder. Palpen schlank.

" Thorax glatt und matt. Parapsidenfurchen scharf. Mesopleure poliert glatt. Mittelsegment körnig rauh und dicht punktiert, hinten Spuren von Querriefung; Metapleure nicht vom Mittelsegmente geschieden und hat dieselbe Skulptur. Schildchen erhaben, matt. Hinterleibstiel ziemlich kurz, gedrungen und etwas gekrümmt, mit sehr feiner Längsriefung, die vorn undeutlich wird; hinten wenig verbreitert. 2. Tergit stark matt (durch aüsserst mikroskopisch feine und dichte Punktierung). Das übrige Abdomen poliert glatt. Legerohr kurz, kaum halb so lang wie das Abdomen. Beine mässig schlank, glatt, Schenkel ziemlich stark verdickt, Hintercoxe eiförmig.

" Stigma ziemlich schlank. Nervulus interstitial. Parallelader interstitial. Die 2. Cubitalzelle fünfseitig, länger und schmäler als die 3. Cubitalzelle. Die Radialader im Hinterflügel völlig verblasst und undeutlich. Basalhälfte des Vorderrandes des Vorderflügels mit sehr langen, senkrecht abstehenden Haaren. 1. Abschnitt des Radius kaum halb so lang wie die erste Cubitalquerader, 2. Radialabschnitt doppelt so lang wie die 2. Cubitalquerader. Radialader im Hinterflügel fehlt.

" Der ganze Körper hell rostgelb, Augen schwarz; die 3 bis 4 letzten Fühlerglieder schwarzlich, die übrigen Geisselglieder an der aüssersten Spitze etwas grau gefärbt. Vorderes Drittel des 3. Abdominaltergites hellbraun, die vordere Hälfte des 4. Tergites braun. 5. und 6. Tergit dunkelbraun mit hell rostgelbem hinteren Viertel. 7. Segment braun, Spitzenhälfte hell rostgelb. Legerohr hell rostgelb, Spitzenhälfte schwarz. Klauen dunkelbraun. Flügel hyalin, in der Mitte der Spitzenhälfte ein grosser hellbrauner Fleck, der sich längs des Radius bis zum Stigma hinzieht und die Spitzenhälfte derselben dunkelbraun ausfüllt. Basalhälfte des Stigma schmutzig weisslich. In der Mitte der Basalhälfte ein kleiner hellbrauner Fleck. Adern dunkelbraun, an der Flügelbasis und an der Spitze farblos. Hinterflügel hyalin. Membran lebhaft in allen Farben irisierend.

" Körperlänge 3¾ mm. Vorderflügellänge 2¾ mm. Fühlerlänge 5 mm. Länge des Hinterleibstieles, 0·8 mm. Länge des Legerohres 0·9 mm.

" Süd-Formosa. Takao. 11.August 1907. 1 ♀ gesammelt von H. Sauter. Type im Stettiner Zoologischen Museum. Zwei weitere Exemplare sind viel kleiner, haben den Hinterleib verloren, gehören wahrscheinlich zur gleichen Spezies und sind vielleicht ♂.

" Vorderflügellänge 1·9 mm.

" Süd-Formosa. Cyamma. 4.Juni 1907. 1 Ex. (?♂) gesammelt von H. Sauter.

" Süd-Formosa. Takao. 6.August 1907. 1 Ex. (?♂) gesammelt von H. Sauter."

Stenophasmus mimeticus Enderlein.

Stenophasmus mimeticus Enderlein, 1912, *Arch. Naturgesch.* **78** (A2) : 12–13.

" Die Art unterscheidet sich von *Stenophasmus annuliventris* durch Folgendes :

" Geisselglieder noch etwas schlanker. Fühler 23-gliedrig. Parapsidenfurchen wenig deutlich, kurz und wenig scharf eingedrückt. Hinterleibstiel nach hinten eine Spur verbreitert, kaum gekrümmt; Längsriefung etwas schärfer, etwas gerunzelt. 2. Tergit weniger matt, so lang wie die übrigen Segmente, die glatt sind. Erster Radialabschnitt noch etwas kürzer, 2. noch etwas länger.

" Kopf und Thorax dunkel rostfarben. Fühler rostgelb, die fünf letzten Glieder grauschwärzlich, ebenso die Endviertel der übrigen Geisselglieder. Beine dunkel rostfarben, Tarsen hell rostgelb, letztes Glied dunkel rostfarben. Hinterleibstiel rostgelb, der übrige Hinterleib dunkel rostbraun. Legerohr rostgelb, Scheiden dunkel rostbraun, Basalhälfte heller. Flügel dunkelbraun, weisslich hyalin ist ein mondsichelförmiger Aussenrandsaum, die Basalhälfte des Stigma und ein anschliessender Fleck hinter ihm, 2. undeutliche Flecke basalwärts davon, das Basalviertel des Vorderflügels und ein Randfleck ausserhalb der Brachialzelle. Hinterflügel hyalin.

" Körperlänge 2·4–2·6 mm., Vorderflügellänge 2·1 mm., Fühlerlänge 3·1 mm., Länge des Abdominalstieles 0·6 mm., Länge des Legerohres 0·9 mm.

" Süd-Formosa. Takao. 13 Januar 1907. 1 ♀ gesammelt von H. Sauter.

" Sud-Formosa. Takao. 20. April 1907. 1 ♀ gesammelt von H. Sauter.

" Type im Stettiner Zoologischen Museum. Diese Spezies ist mimetisch mit *Spathiohormius ornatulus* Enderl. aus Formosa."

Stenophasmus obesus Enderlein.

Stenophasmus obesus Enderlein, 1912, *Arch. Naturgesch.* 78 (A2) : 10.

" ♀. Gesicht rauh punktiert. Stirn und Scheitel mit sehr feiner und sehr dichter Querriefung; Stirn hinter jedem Fühler etwas eingedrückt. Hinterhaupt, Schläfen und Wangen poliert glatt. Ocellen ziemlich dicht gedrängt. Fühler lang, Geisselglieder lang.

" Thorax matt (nur mikroskopisch fein skulpturiert), Propleure vorn matt, hinten mit einigen Längskielen. Mesopleure ziemlich glatt, oben mit einigen Längskielen, der tiefe untere Längseindruck mit Querkielchen gefüllt. Metapleure unregelmässig fein und undeutlich querrunzlig. Pleuren mit weissgrauen Haaren ziemlich dicht besetzt. Mittelsegment matt, hintere Hälfte ziemlich grob unregelmässig netzrunzlig; mit 5 Längskielen, der mittlere zu einer Area centralis gegabelt. Hinterleibstiel kurz, ein wenig gekrümmt und etwas kräftig hinten stark verbreitert, oben mit etwas rauhen Längsriefen und mit langen, abstehenden zerstreuten Haaren. 2. Tergit matt (durch mikroskopisch feine Punktkörnelung), Enddrittel und das übrige Abdomen poliert glatt. Beine mässig schlank, Schenkel und Schienen mit ziemlich langen, ziemlich senkrecht abstehenden Haaren mässig dicht besetzt.

" Basalhälfte des Vorderflügelvorderrandes behaart, Stigma mässig schlank. 2. Cubitalzelle etwas länger als die dritte. Nervulus etwas postfurcal. Radialader im Hinterflügel fehlt.

" Kopf rostgelb, Fühler dunkel rostgelb bis graubraun, die Spitze jedes Geisselgliedes schwarz. Thorax rostrot, hinten und unten rostbraun. Abdomen rostrot, ebenso die Beine mit den Coxen. Schienen wenig verdunkelt. Flügel braun, hyalin ist das Basalviertel, das Spitzenfünftel und ein schmales Band mitten durch Flügel von dem proximalen Teil des Stigma bis zum Hinterrand dicht ausserhalb der Brachialzelle. Membran lebhaft in allen Farben irisierend.

" Körperlange 5 mm., Vorderflügellänge 4¼ mm., Länge des Hinterleibstieles 1·4 mm., Länge des Legerohres 3·5 mm.

" SUMATRA. Soekaranda, 1 ♀. Dr. H. Dohrn. Type im Stettiner Zoologischen Museum."

Stenophasmus sumatranus Enderlein.

Stenophasmus sumatranus Enderlein, 1912, *Arch. Naturgesch.* 78 (A2) : 9.

" ♀. Gesicht rauh und dicht körnig punktiert. Stirn in der Mitte mit feinen Querriefen, sonst poliert glatt, ebenso Scheitel, Hinterhaupt, Schläfen und Wangen. Ocellen dicht gedrängt. Fühler lang, Geisselglieder sehr lang.

" Mesonotum kräftig quergerieft, vorn und an den Seiten matt und ohne Sculptur. Mittelsegment mit kräftigen Querriefen, vorderes Viertel glatt, mit fünf Längskielen, von denen nur die seitlichen bis zum Hinterrand reichen, die übrigen erreichen kaum die Mitte. Propleuren schräg gerieft. Mesopleuren poliert glatt. Hinterleibsstiel lang und dünn, mit verstreuter, langer, senkrecht abstehender Behaarung, mit einigen undeutlichen Längskielen, die in der Mitte fast verschwinden und hinten wieder deutlich sind. 2. Abdominalsegment fast halb so lang wie der Stiel, mit äusserst feiner und äusserst dichter paralleler Riefung, die im hinteren Drittel quer verlaüft, im übrigen Teil längs, und an den Seiten hinten setzt sich die Querriefung in die Längsriefung fort (nur mit sehr Starker Lupe erkennbar, mit schwacher Lupe als matte Oberfläche erscheinend); äusserster Hinterrand poliert glatt wie das übrige Abdomen. Länge des Legerohres 11 mm., Beine schlank, Schenkel verdickt, Coxen, Schenkel, Schienen und erste Tarsenglieder mit zerstreuter sehr langer senkrecht abstehender Behaarung. Basalhälfte des Flügelvorderrandes lang abstehend behaart. Stigma mässig schlank. Nervulus interstitial.

" Kopf schwarz, Gesicht dunkel rostbraun, Mundteile rostfarben, Palpen blass bräun-

lichgelb, Fühler dunkel rostbraun, die fünf ersten Glieder rostgelb. Thorax schwarz, Tegula rostgelb. Abdomen rostfarben, Spitzenviertel schwärzlich; bei einem Stücke ist der Hinterleibstiel schwarz. Beine mit den Coxen hell rostgelb, Hinterschenkel rostgelb, Behaarung hell graugelblich. Flügel hyalin mit bräunlichem Ton. Adern und Stigma braun.

"Korperlänge 8½ mm., Vorderflügellänge 5¼ mm., Länge des 1. Abdominalsegments 3 mm.

"SUMATRA. Soekaranda. 2 ♀. Dr. H. Dohrn. Typen im Stettiner Zoologischen Museum."

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THE NATURAL FOODS AND THE FOOD REQUIREMENTS OF SEVERAL SPECIES OF STORED PRODUCTS INSECTS

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A. Introduction.

Most of the common insect pests of stored foods are known to infest a variety of different foodstuffs. Books on the subject, like those of Zacher (1927, 1933), Kemper (1939), Hayhurst (1940), and monographs on the more important insects contain extended enumerations of foods which are attacked by each insect. Not all such data are equally reliable. They are often quotations from sources in which it has not been made sufficiently clear whether the insect has developed on the food itself, or migrated to it from other sources of infestation, or has been feeding on other insects or on moulds which primarily infested the food. To come to a proper understanding of the food habits of economically important insects, two types of information are required : knowledge of the basic food requirements of each insect and reliable data on the suitability of each particular food for each insect. With this information available it was hoped to arrive at a correlation between these two different sets of data by which the food habits of an insect would be, at least partly, explained by its basic food requirements.

Most of our investigations into the dietetics of several insects have been published or are being published elsewhere (Fraenkel, Reid and Blewett 1940, Fraenkel and Blewett 1941, 1942 a and b, 1943, a–g). Table 1 contains a summary of some of the results relevant to the present investigation. All the insects concerned (with the exception of *Ephestia kühniella*) grow equally well on wholemeal flour or on a semisynthetic diet consisting of casein, starch or glucose, yeast, cholesterol, salts and water. By leaving out one of the constituents of this diet (starch, cholesterol or yeast) at a time the relative importance of these constituents was established. As a result of these tests, and

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Table 1.

Basic Food Requirements of Some Flour Insects.

Complete diet: 50 parts casein, 50 p. starch, 3 p. cholesterol, 5 p. dried yeast, 1 p. salts, 15 p. water.

	Tribolium	*Silvanus*	*Sitodrepa*	*Lasioderma*	*Ptinus*	*Ephestia kühniella*
Complete diet .	++++	++++	++++	++++	++++	++
Without starch	++	−	±	+++	++	−
Without cholesterol . .	+++	+++	±	+++	++	−
Without yeast .	−	−	−	−	−	−

many others, certain principles have become apparent by which the basic food requirements of insects may differ:—

(1) All insects require a sterol in the food, but their requirements differ qualitatively and quantitatively. *Dermestes vulpinus* Fab. grows only on cholesterol, the natural sterol of animal tissues, whereas the flour insects grow just as well on cholesterol or sitosterol, the sterol of higher plants, or ergosterol, the sterol of micro-organisms. For *Tribolium*, *Lasioderma*, *Silvanus* and *Ptinus* the amount of sterol contained in 5% yeast is almost sufficient, whereas *Sitodrepa* and *Ephestia* require larger quantities.

(2) *Ephestia*, *Silvanus* and *Sitodrepa* require carbohydrates in their diet. *Tribolium*, *Lasioderma* and *Ptinus* do not. This difference is bound to influence greatly their choice of food, because insects which require carbohydrates cannot be expected to grow on foods with a low carbohydrate content like yeast or fishmeal.

(3) The water content of many dried foods is of the order of 10–15% and it is adaptation to such low water contents which characterises all stored products insects. Some foods like dried milk, however, have a much lower water content, and others like dried fruits a higher one, and it seems that different insects tolerate low or high water contents of their food to a different degree. This is bound to influence greatly their choice of food.

(4) All insects seem to require vitamins of the B-group. *Tribolium* and *Ptinus* require at least seven vitamins of the B-group: B_1, riboflavin, nicotinic acid, pyridoxin, pantothenic acid, choline and biotin, and possibly also inositol and *p*-amino-benzoic acid. The vitamin requirements of *Sitodrepa*, *Lasioderma* and *Silvanus* are similar but less exacting, which may be due to the presence, in these insects, of intracellular micro-organisms. Deficiency of only one of these vitamins in a particular food would be the limiting factor for the growth of an insect. White flour, for instance, has been shown to be essentially deficient in riboflavin for *Tribolium* (Fraenkel and Blewett 1941). Dried milk powder seems to be deficient in one or more factors of the B-group.

In carrying out the second part of the programme, which is recorded in the present paper, the insects have been bred on flour of different extraction, on wholemeal flour at different relative humidities, and on several other dried foods.

B. Methods.

The following insects were used:—

Coleoptera.

Tribolium confusum Duv., TENEBRIONIDAE.
Sitodrepa panicea L., ANOBIIDAE.
Lasioderma serricorne Fab., ANOBIIDAE.
Oryzaephilus surinamensis L., CUCUJIDAE.[1]
Ptinus tectus Boield., PTINIDAE.
Dermestes vulpinus Fab., DERMESTIDAE.

Lepidoptera.

Ephestia kühniella Zell., PHYCITIDAE.
Ephestia elutella Hb., PHYCITIDAE.

As a rule, ten newly hatched larvae were placed on 2 g. of food in a 2 × 1-inch specimen tube. Each test was performed in duplicate, *i.e.* with twenty larvae. With the larger insects, *Ephestia* and *Dermestes*, sometimes tests were done with 4 tubes, containing 5 larvae each and 3 g. of food.

The method of obtaining eggs has been described by Dick (1937) for *Dermestes* and *Tribolium* and was essentially the same for all insects. Adults of *Dermestes* and *Ptinus* were placed on sifted fishmeal, of the other insects on sifted flour, and the eggs were removed in sieves of suitable mesh twice weekly.

The best criterion for assessing the suitability of a diet is the length of larval life, *i.e.* the time from hatching to pupation. This is easy to assess accurately with *Tribolium* and *Dermestes* by daily inspection during the period when pupation takes place. The other insects spin a cocoon and cannot always be observed during the period of pupation unless the cocoon is built on to the glass wall which then serves as a window to the inside. If it is not possible to fix the date of pupation the final result can be obtained by watching the adults as they emerge from the cocoons. Here again difficulties often arise inasmuch as the emerging adults usually remain in the cocoons for several days before appearing in the food. A result is then obtained by combining several kinds of observations—rate of larval growth, time of pupation and/or emergence of the adult.

Of the insects used in this investigation, *Tribolium confusum* proved by far the most favourable test subject. It does not build a cocoon, and both larvae and pupae lie free in the food. This renders it simple to determine accurately the date of pupation by regular and frequent inspection. The larvae are straight and easily measured, which often provides an excellent criterion for the relative efficiency of diets. A further advantage, only realised much later, is the absence of intracellular symbionts, which in other insects seem to complicate the nutritional analysis.

Silvanus surinamensis builds a cocoon which is rather fragile. Cocoons are usually built on the glass wall but break off easily when the tubes are handled and inspected. Possibly from this cause, and other unknown causes, the pupae or young adults sometimes unaccountably die. All these features render *Silvanus* a somewhat unfavourable subject for nutritional studies.

Sitodrepa, *Lasioderma* and *Ptinus* spin cocoons in which they pupate. Most cocoons are fixed to the glass wall and both pupation and emergence can be determined with fair accuracy by inspection from outside. The larvae are curved and their size, when small, cannot easily be measured or assessed. The cocoons give good protection to pupae and young adults. After emergence the beetles stay in the cocoons for several days, and it is not always easy to determine accurately the state of development in cocoons which are not built on the glass wall.

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[1] Often known as *Silvanus surinamensis* L., under which name it is referred to in this paper elsewhere throughout.

Ephestia kühniella presents more difficulties in assessing results than the other 5 species. The larvae spin from the beginning and the webbing formed in the food makes it difficult to detect the young stages. When fully grown, larvae sometimes delay pupation (diapause) without apparent cause, and the pupae, unless formed outside the food in a favourable position, can only be detected by laboriously disentangling webbings and cautiously opening the cocoons. The method finally adopted was to open the cocoons and extricate all larvae 30 days from the start of the experiment. This is the time when the controls on wholemeal flour just start to pupate. The state of development of the larvae expressed by length and/or weight usually gives a good indication of the efficiency of a diet. After that the cultures remained untouched until the moths emerged and the dates of emergence were carefully noted. Sometimes the first inspection after 30 days was omitted.

These differences in the method of assessing results make it impossible to express the results in simple numerical data suitable for comparison between the different species. Therefore for this purpose a method of expressing a result by + and — signs is used.

Most of the results are graphically summarised in curves in which the total number of pupae or adults formed is plotted against time. With an optimal diet growth is fast, the variations between individuals are relatively small, and the mortality is low. The curves therefore are shifted to the left, are steep and reach a high level. As diets become more unfavourable, growth becomes retarded, the variations between individuals become larger and the mortality rises. The curves therefore become shifted to the right, they are shallower and only reach a low level. Unfortunately the curves cannot express the result of totally unfavourable diets when the larvae die before reaching the pupal or adult stage.

During the tests the insects were kept at a constant temperature of 25° C. and at a relative humidity of 70%, except where otherwise stated.

C. EXPERIMENTS.

(1) *Growth on flours of different extraction.*

It has been known for a long time that white flour is very much less attacked by insects than wholemeal flour. War-time regulation of the degree of extraction of flour made it desirable to obtain information on the liability or otherwise of the newly specified flours to insect attack. Extraction of white flour was at first raised to 72%, then to 73% and finally to 75% (National Straight Run). At the same time a new specification for a wheatmeal of 85% came into force (National Wheatmeal). The patent flour used was " Burtons best " and is believed to be of about 40% extraction. The 73, 85 and 100% flours were milled at the Research Association of British Flour Millers and came from the same grist. We obtained them through the courtesy of Dr. H. Chick of the Lister Institute. Figs. 1 to 7, summarised in table 11 (p. 478), show clearly that with all the insects tested the patent flour has the lowest food value and 85 and 100% flour the highest, the 73% flour being intermediate. But quantitatively the different insects show vast differences, particularly as to their ability to develop on patent flour. All the insects grew just as well on 85% flour as on 100% flour.

Tribolium confusum grows very much more quickly on N.S.R. than on patent flour and still better on 100 and 85% flour. The relative nutritional value of flours of different extraction is similar for *Tribolium*, *Silvanus* and *Lasioderma*. On *Sitodrepa* and *Ptinus* a low extraction seems to have a still more unfavourable effect. N.S.R. is very greatly inferior to 100 and 85% flour, and on patent flour only a few larvae reach pupation after a long delay.

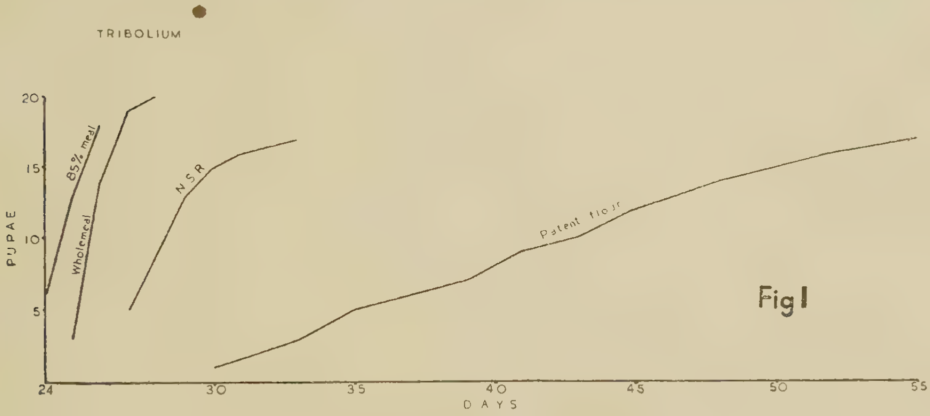

Fig. 1.—Growth of *Tribolium confusum* on flour of different extraction. Wholemeal = 100% extraction, N.S.R. (National Straight Run) = 73% extraction, Patent flour = approximately 40% extraction.

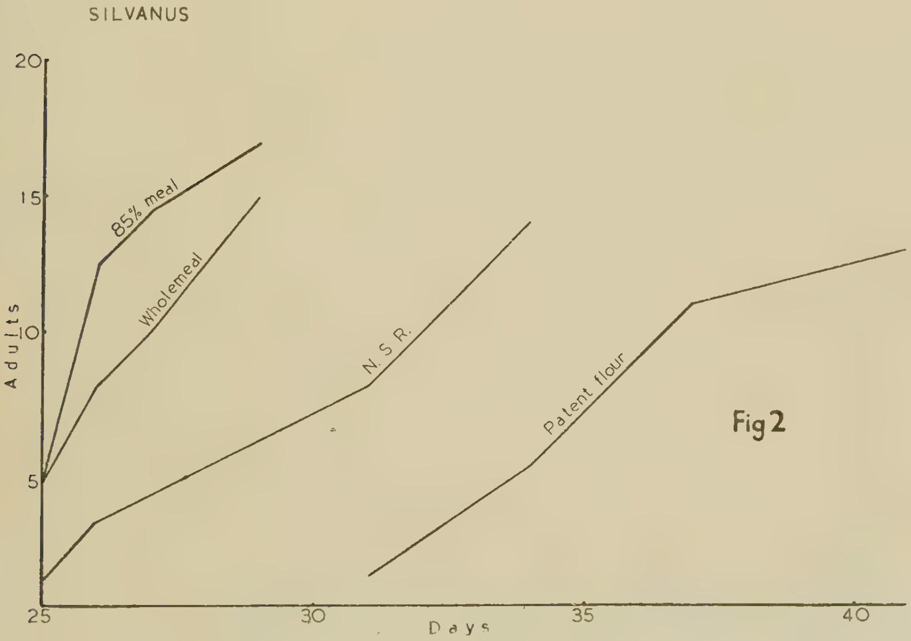

Fig. 2.—Growth of *Silvanus surinamensis* on flour of different extraction. Explanation as fig 1.

Essentially the same difference as in these two groups of beetles is observed in the two *Ephestia* species, *kühniella* and *elutella*. The former grows about twice as slowly on N.S.R. and three times as slowly on patent flour as it does on 100 and 85% flour. But ultimately even on patent flour a large number reach the moth stage. For *Ephestia elutella* even 100 and 85% flours are unfavourable diets when compared with middlings and wheat germ (see later on p. 465). Growth on N.S.R. is exceedingly slow. After 10 months 1 moth emerged and there were still about 3 half-grown larvae in the food. On patent flour a few very small larvae still survived after 10 months.

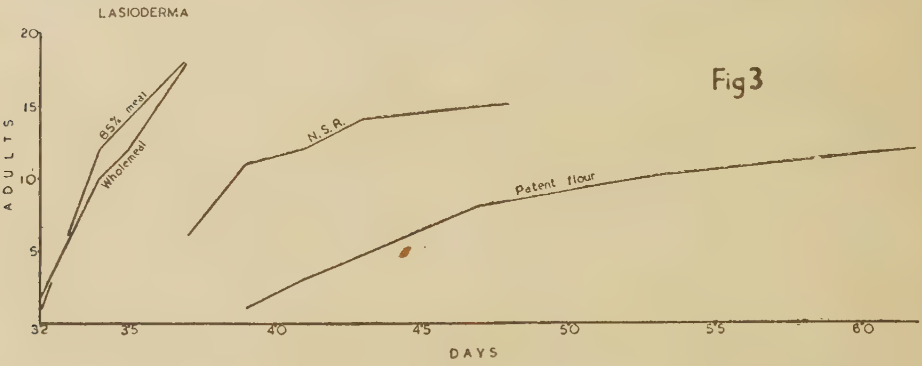

Fig. 3.—Growth of *Lasioderma serricorne* on flour of different extraction. Explanation as fig. 1.

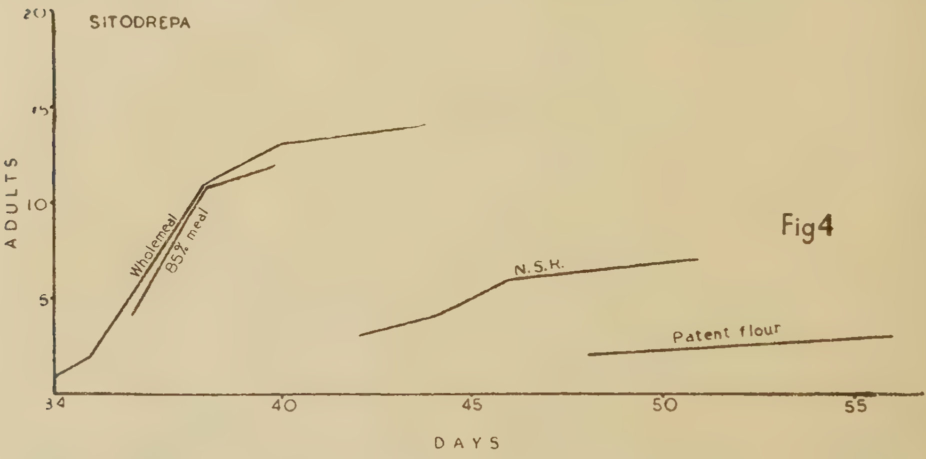

Fig. 4.—Growth of *Sitodrepa panicea* on flour of different extraction. Explanation as fig. 1.

It has been demonstrated before that *Tribolium confusum* (Chapman 1924, Good 1932) and *Ephestia kühniella* (Richardson 1926) develop on flour of high extraction better and faster than on low extraction flour. We obtained similar

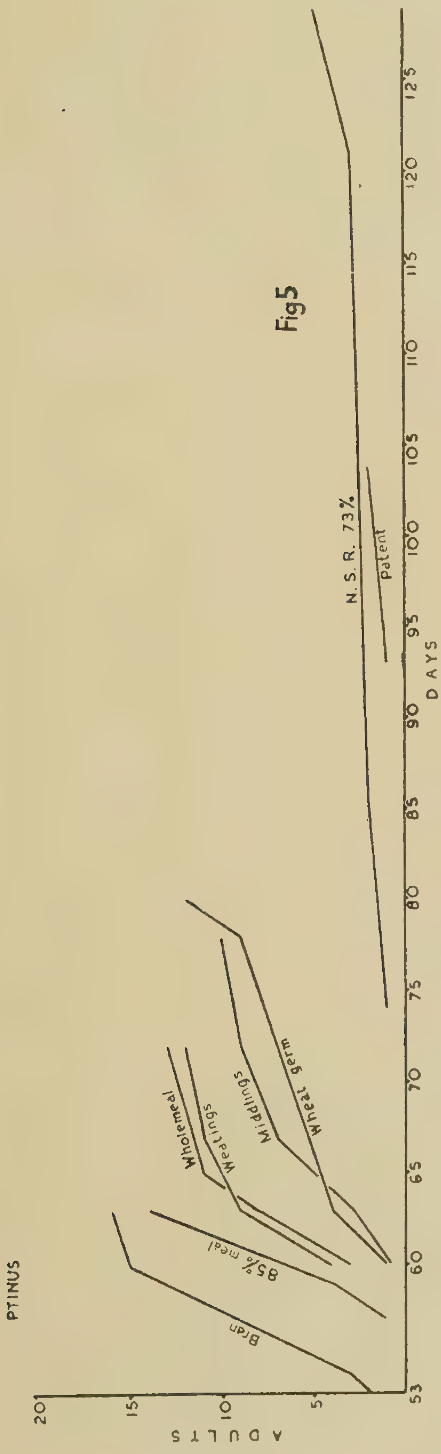

Fig. 5.—Growth of *Ptinus tectus* on flour of different extraction. Explanation as fig. 1.

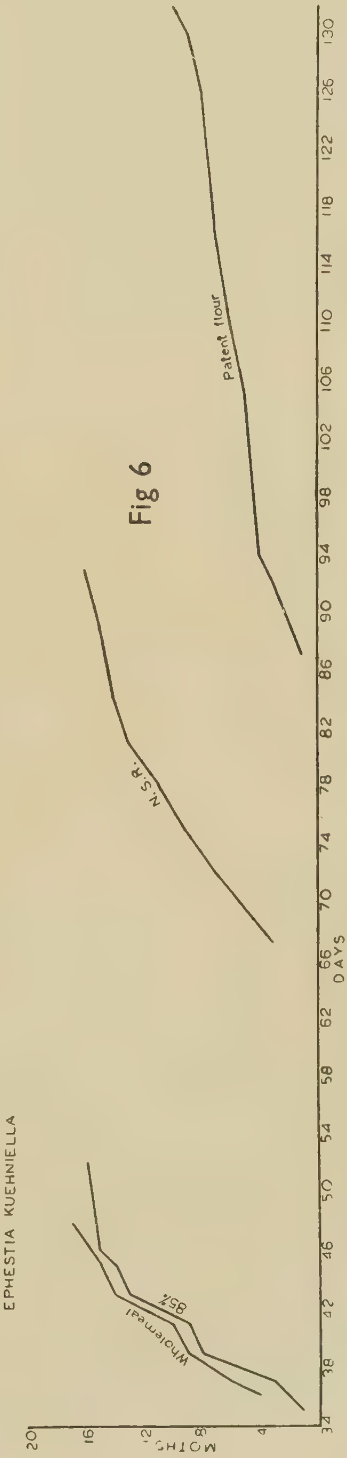

Fig. 6.—Growth of *Ephestia kühniella* on flour of different extraction. Explanation as fig. 1.

results with these two insects and also with four others. Lowering the degree of extraction from 100 to 85% has no marked effect.

The content of B-vitamins of flour decreases as the degree of extraction is lowered, and patent flour only contains a small fraction of the vitamins originally present in the wheat berry. This fact has been well established for the more important members of the B-group, viz. B_1, riboflavin, nicotinic acid, B_6 and pantothenic acid and is likely to hold also for the other factors which have not yet been investigated in this respect. (Thomas et al. 1942, Andrews et al. 1942, Tepley et al. 1942). For *Tribolium confusum* we have previously demonstrated that the particular sample of patent flour used by us (Burtons best) is specifically deficient in riboflavin. Adding riboflavin alone to this patent flour brings its nutritional quality almost up to that of 100 and 85% flour (Fraenkel and Blewett 1941). 73% flour is also markedly improved for *Tribolium* by riboflavin. A different sample of patent flour has been shown by Barton-Wright (1941) to be deficient in nicotinic acid and B_1 as well as in riboflavin for *Tribolium.* On the other hand, in our experiments growth of *Ephestia elutella* on patent flour was not improved by adding riboflavin alone.

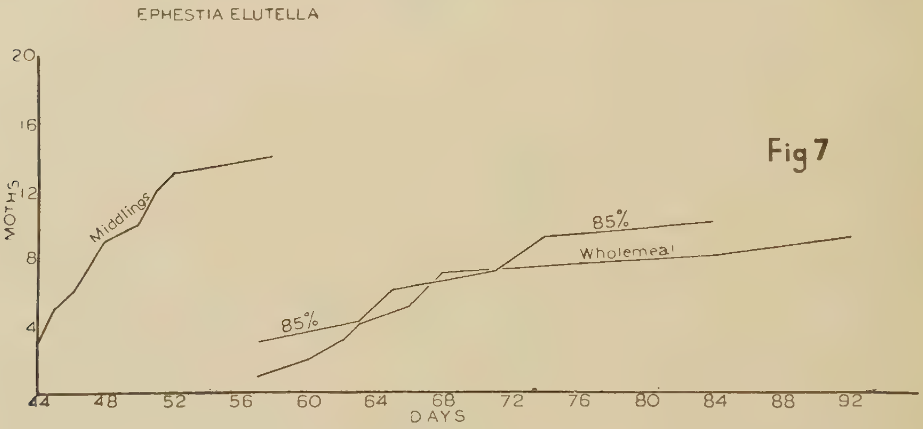

FIG. 7.—Growth of *Ephestia elutella* on flour of different extraction. Explanation as fig. 1.

The fact that the lowering of the extraction of flour has a different effect on the two *Ephestia* species, *kühniella* and *elutella*, requires some comment. The flour moth *E. kühniella* has been known for many decades as one of the most serious pests on flour in practically every country in the world. It develops best on flour of a high extraction, but also breeds, although at a slower rate, on highly milled patent flours. *Ephestia elutella* is known as a major pest on tobacco, cacao beans and dried fruit. During the last war a heavy infestation of this moth occurred unexpectedly on stocks of grain stored for long periods (Dendy and Elkington 1919). With *E. elutella* established in stored grain it is important to know whether its transfer into flour mills and thus into stored flour is likely to have serious consequences. As far as we are aware, *E. elutella* has never been reported as a serious pest on flour. In war time the conditions are, however, different. Flour is stored for much longer periods and the minimum extraction of flour has been raised everywhere. Our experiments show conclusively that *Ephestia elutella* will not grow on flour of peace-time extraction, which is just below 70%, while it grows well on present-day war-time flour of

85% and higher extraction. The rate of development on 85 and 100% flour is not optimal, being very much faster on "middlings" (fig. 7). Middlings, the fraction which is removed in the manufacture of white flour, contain greater amounts of vitamins of the B-group than whole grain and therefore it may well be that even in 100% flour there is a lack of certain vitamins of the B-group which are necessary for optimum development of *E. elutella*. Unpublished experiments by Waloff show that *E. elutella* develops still faster on wheat germ than on middlings, germ having a still greater content of vitamins of the B-group than middlings. White flour, therefore, is an inadequate food for *E. elutella*, but is not inadequate for *E. kühniella*. This accounts for the fact that only the latter species has hitherto been known as a flour pest. The results of this study show conclusively that *E. elutella* may any day become a serious pest in stores of wholemeal or wheatmeal flour.

(2) *Growth on wholemeal flour in equilibrium with different humidities.*

The tests on flours of different extraction, described in the foregoing section, were carried out at a humidity of 70%, which corresponds to a moisture content of the flour of about 14%. In the following section we describe the influence on larval growth of varying the humidity and thereby the moisture content of wholemeal flour. The moisture content of flour at different humidities varies somewhat in different samples and during the course of a test usually went up slightly as seen in table 2.

The tests were carried out in desiccators containing KOH-solution of the appropriate strength to give the required humidities (according to tables in Buxton 1931) and the temperature was again 25° C. No attempt was made to measure the humidities inside the desiccators.

Figs. 8 to 11, which are summarised in table 2, show clearly that the higher the humidity the faster the growth of the larvae of all the insects. There are, however, very striking differences with regard to the influences of the different humidities. At $12\frac{1}{2}\%$ relative humidity growth of *Ephestia* and *Tribolium* is very much retarded, but most larvae finally pupate and emerge as adults. With *Silvanus* the number of insects which complete development decreases sharply as the humidity decreases. *Ptinus*, *Lasioderma* and *Sitodrepa* showed a steep decline in growth rate and survival from 70 to 50% humidity and no larvae completed development at the lower humidities. Even 40% humidity proved too low for these three species. The development of three insect species on a food containing only about 5·5% water was much better than we had expected, but this has been recorded before for *Ephestia*. Ahmad (1936) even states that *Ephestia* can still grow on food in equilibrium with 0% relative humidity. This claim looked so incredible that we repeated the experiment.

TABLE 2.

Growth on wholemeal flour at different humidities.

Relative humidity, %	Water content, %	*Tribolium*	*Silvanus*	*Lasioderma*	*Sitodrepa*	*Ptinus*	*Ephestia kühniella*
70	12·8 –13·9	++++	++++	++++	++++	++++	++++
50	10·23–11·3	+++	+++	+++	+++	++	+++
40				–	–	–	
30	7·9 – 8·6	++	++	–	–	–	++(+)
$12\frac{1}{2}$	5·4 – 6·9	+(+)	+(+)	–	–	–	++
0	1 – 2						+(+)

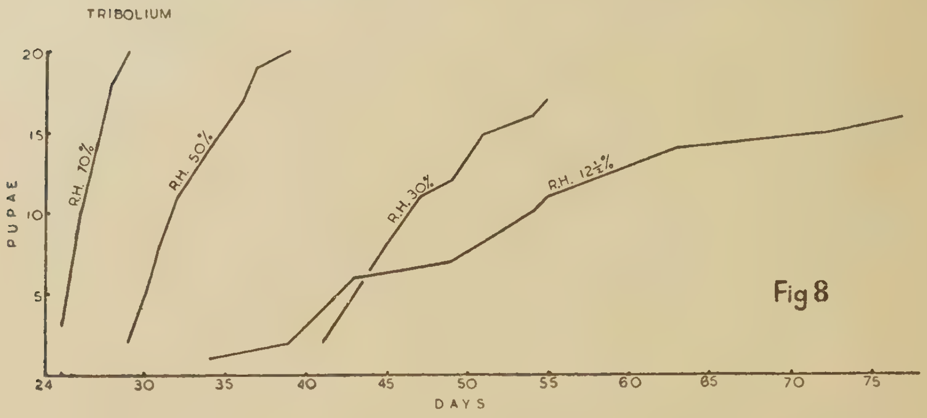

FIG. 8.—Growth of *Tribolium confusum* on wholemeal flour in equilibrium with different relative humidities.

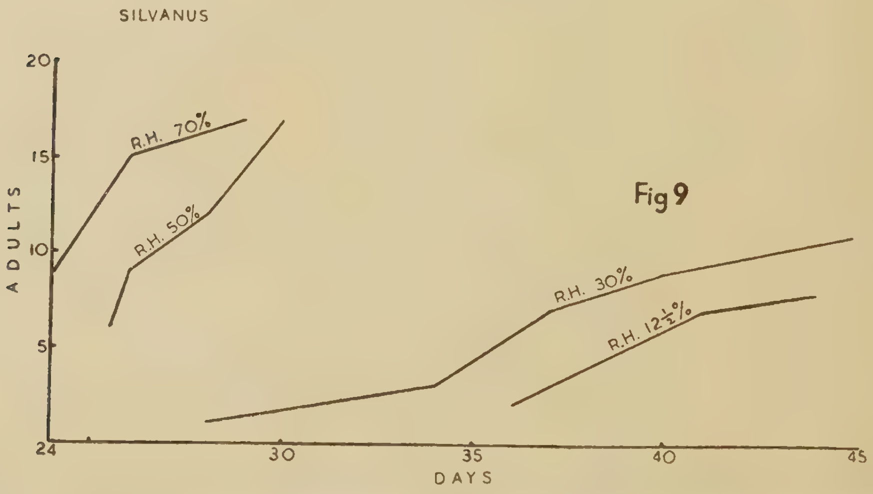

FIG. 9.—Growth of *Silvanus surinamensis* on wholemeal flour in equilibrium with different relative humidities.

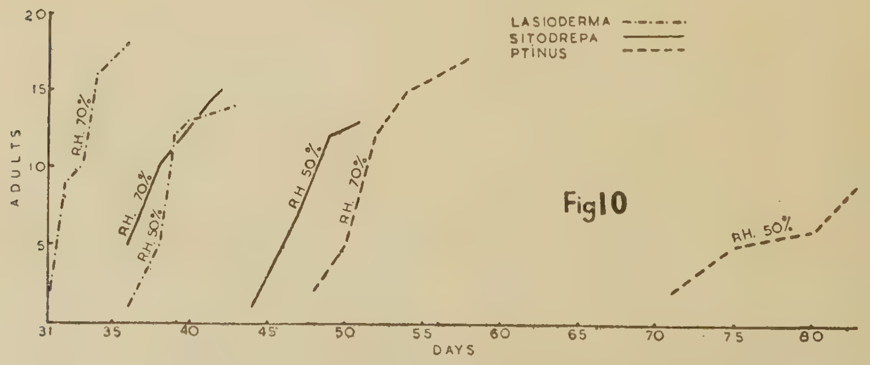

FIG. 10.—Growth of *Lasioderma serricorne*, *Sitodrepa panicea* and *Ptinus tectus* on wholemeal flour in equilibrium with different relative humidities.

Young larvae were placed on flour which had been dried at 110° and was afterwards kept over P_2O_5. The moisture content at the beginning of the experiment was about 1% and rose in the course of time to about 2%. After three weeks the flour was changed, and throughout the experiment the depths of the flour in the glass tubes was kept as low as possible to avoid creation of a zone of higher humidity inside the food. Out of 16 larvae 9 pupated and emerged as moths (fig. 11).

It was not possible to raise the humidity above 70%, because at the higher humidities moulds almost invariably began to grow in the diets which made the results unreliable. It would be, however, very interesting to know whether there is an upper limit of moisture content for these insects which are adapted to subsist on a particularly dry food. Although experiments could not be carried out in very high humidities, some interesting suggestions were obtained from tests of a different nature. In the course of feeding experiments on a semisynthetic diet, composed of casein, carbohydrates, yeast, sterols and salts an attempt was made to test the nutritional value of carbohydrates other than starch.

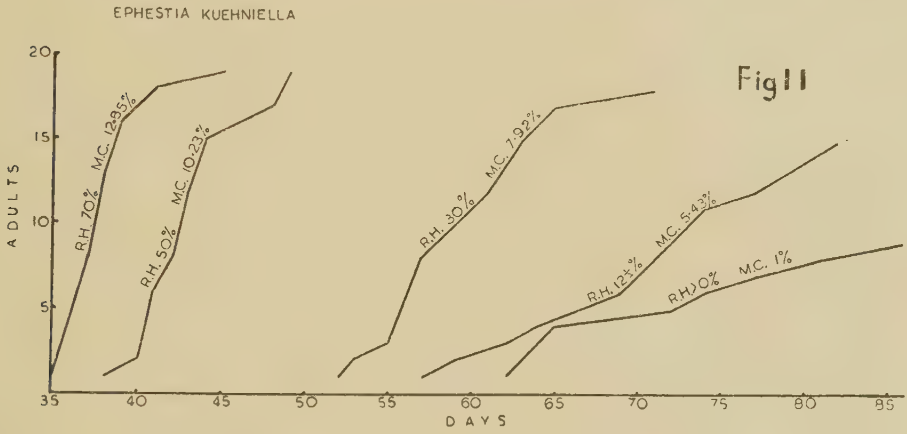

FIG. 11.—Growth of *Ephestia kühniella* on wholemeal flour in equilibrium with different humidities.

It soon became obvious that the water content of diets containing different sugars differed greatly when in equilibrium with 70% humidity. With glucose in the diet the water content is about 12%, with sucrose, lactose or mannitol only about 6%, whereas with the hygroscopic sugars, fructose, mannose or sorbitol it is as high as 18–20%. *Sitodrepa* grew well on the dry mannitol diet and not at all on the moist fructose and sorbitol diets. *Tribolium* grew well on mannitol, somewhat worse on sorbitol and not at all on fructose. A fructose diet was also entirely unsuitable for *Ptinus* and *Lasioderma*. *Silvanus*, on the other hand, while growing quite well on mannitol, grew excellently on fructose and sorbitol. *Ephestia kühniella* on the whole grew badly on synthetic diets but it did much better on the moist fructose and sorbitol diets than on any others tried.

The interpretation of these results is complicated, because utilisation of a sugar has to be taken into account as well as water content, and one has also to consider that *Tribolium*, *Lasioderma* and *Ptinus* grow well without carbohydrates whereas *Silvanus*, *Sitodrepa* and *Ephestia* must have them. Taking these results for what they are worth it seems that *Tribolium*, *Sitodrepa*, *Ptinus* and *Lasioderma* are limited to drier foods than *Silvanus* and *Ephestia kühniella*. It is perhaps significant in this connection that *Silvanus* is a serious pest on dried fruit, which has a high fructose content and a water content usually much above that of other dried foods.

It is a fact well known to all students of stored products insects that the speed of development is dependent on the water content of the food (*e.g.* van Emden 1929). Holdaway (1932) has shown the duration of development of *Tribolium confusum* to be 30·1 days at 25% relative humidity, 25·5 days at 50% relative humidity and 22·6 days at 75% relative humidity, at 27° C. Brief mention has already been made of Ahmad's (1936) study on the influence of varying the humidity on the development of *Ephestia kühniella*. He also found increasing speed of development with rising humidity, and claims that at 23° C. some larvae completed development at a saturation deficiency which would correspond to a humidity of 0%. These extremely dry conditions were produced over solid P_2O_5, and in order to ensure efficient drying the layer of food was kept as thin as possible and more food was added from time to time. It is quite obvious that even under these conditions the humidity cannot have been quite as low as was claimed. In our tests, carried out under the same conditions, the water content of the food was found to be 1–2% instead of 0%. Even with this correction it is a very remarkable fact that any animal is able to develop under such extremely dry conditions. In Ahmad's tests about 30% of the larvae completed development. In our tests more than 50% of the larvae turned into adults. The water content of an *Ephestia* larva is about 68% and there cannot be the slightest doubt that under extremely dry conditions the water necessary for building up tissues and maintaining life is provided by the metabolism. It may well be that this excessive strain on metabolism in supplying water is one of the causes which slows down growth under dry conditions.

Ahmad also studied the effect of extreme dryness on egg laying and on egg development of *E. kühniella*, and found the effect to be even less adverse than it was with regard to larval growth. From this it appears that *Ephestia* will successfully, although at a slower rate, breed on flour with practically no water in it. Keeping flour very dry can, therefore, never protect it from attack by *Ephestia kühniella*. The same is true for all practical purposes for *Tribolium confusum* and *Silvanus surinamensis* which both complete development in flour with a water content as low as 6·5%.

The view that certain insects which live under extremely dry conditions, like mealworms and clothes moths, obtain their necessary water by metabolising food has often been expressed, although to the best of our knowledge it has never been proved. Almost all the work done on this subject concerned starving insects with the view to finding out whether the effect of extreme desiccation is counteracted by increased metabolism. According to Mellanby (1936) no such increased production of metabolic water has ever been demonstrated, nor would it be likely to be of advantage for an insect, because increased metabolism would lead to increased loss of water by evaporation. It is difficult to see how this argument would apply to insects which are living on very dry food. If the water content of a food is 10–15%, as with grain or flour, and an insect grows up with a water content of 60–70%, the conclusion seems inevitable that the greater part of its water is derived from its metabolism. The only alternative explanation is that the amount of water ultimately found in the fully grown larva plus the combined loss of water in the faeces and by evaporation is less than the amount ingested with the food. This has never been proved to be the case, and it cannot possibly apply in the case of an insect developing on a food containing only 1% of water (*vide* postscript p. 488).

(3) *Growth on whole grain.*

All the insects dealt with in this paper, while being typical pests of flour, also occur commonly in stored grain. Wheat always contains a certain amount of flour dust and of grains which are more or less damaged. It was considered of interest to discover whether these insects are able to attack intact grains, or whether they merely grow on the already damaged grains. The first series of tests was undertaken with grain which on superficial inspection seemed to be undamaged. Later, upon closer inspection under magnification, almost all the grains revealed minor damage in the bran layer covering the germ. Subsequently a sample of English grain was obtained which was exceptionally free from superficial damage. Grains which on inspection under magnification looked entirely intact ("undamaged grain" in the following tables) were then separated from grains which revealed microscopically small crevices in the germ region ("very slightly damaged"). The sample first used, which showed crevices or breaks in the branny layer covering the germ, was termed "slightly damaged." "Damaged grain" was obtained by breaking grains in a mill into large fragments and removing flour produced in this process by sifting. After it became clear that some of the insects would not feed on undamaged grain it was considered of interest to find out whether older larvae were able to tackle them with more success. Larvae were reared for a fortnight (*Silvanus* for one week) on wholemeal flour and then transferred to undamaged grain. After finishing the tests the grains were closely inspected and the damage caused by the insects recorded. The results are set out in tables 3 to 8.

Tribolium confusum.

TABLE 3.

Tribolium.

Grain	No. of larvae	No. of pupae	Period of pupation, days	No. of grains	No. undamaged	No. damaged	Type of damage
1. Undamaged . . .	20	0	—	*ca.* 180	All undamaged	—	Embryos entirely eaten; sometimes also some adjoining endosperm.
2. Undamaged larvae 2 wks. old	20	10	47–60	73	55	18	
3. Very slightly damaged .	20	14	49–72	182	149	33	
4. Slightly damaged . .	20	18	34–58	105	36	69	
5. Damaged	20	18	27–35				
6. Wholemeal . . .	20	18	27–31				

Tribolium first stage larvae are clearly unable to develop on entirely undamaged grain but can make use of it if the grains show microscopically small lesions in the germ region. With increasing initial damage the grain becomes a more favourable breeding medium, which is shown by the decreasing period of development. But the grain must be very grossly damaged to constitute a food which is similar in efficiency to wholemeal flour. 14-days old larvae can develop successfully on undamaged grain, although they grow on it rather slowly.

Silvanus surinamensis.

Table 4.

Silvanus.

Grain	No. of larvae	No. of adults	Period of emergence, days	No. of grains	No. undamaged	No. damaged	Type of damage
1. Undamaged . . .	20	3	30–43	*ca.* 180	?	3 ?	1 hole in germ. 2 large holes in endosperm ? ?.
2. Undamaged larvae 2 wks. old	20	0	—	78	78	0	
3. Very slightly damaged .	20	3	40	188	185	3	Germ or portion of germ eaten. Bran remains.
4. Slightly damaged . .	20	11	28–36	102	81	21	
5. Damaged	20	20	26–28				
6. Wholemeal . . .	20	15	25–29				

Silvanus cannot develop on entirely undamaged or even on very slightly damaged grain, whether started on it immediately after hatching from the egg or 7 days later. The few cases of development in lines 1 and 3 of table 4 probably occurred on grains which were superficially damaged in places other than the germ and where the damage had been overlooked. When the branny layer covering the germ has tiny crevices, some of the larvae manage to eat their way inside and eat the germ out without damaging or removing the branny cover. Development on grossly damaged grain is about as good as on wholemeal flour.

Lasioderma serricorne.

Table 5.

Lasioderma.

Grain	No. of larvae	No. of adults	Period of emergence, days	No. of grains	No. undamaged	No. damaged	Type of damage	
							Embryos entirely removed and some adjoining endosperm	Grain superficially damaged
1. Undamaged . . .	20	3	43–58	164	145	19	5	14
2. Undamaged larvae 2 wks. old	20	17	38–53	71	30	41	25	16
3. Very slightly damaged .	20	7	43–58	190	173	17	8	9
4. Slightly damaged . .	20	14	34–55	101	52	49	35	14
5. Damaged	20	18	34–47					
6. Wholemeal . . .	20	19	32–43					

Only very few first stage larvae of *Lasioderma* succeed in growing on entirely undamaged grain, and the number increases as the grain is more damaged. Fortnight-old larvae successfully attack undamaged grain.

Sitodrepa panicea.

Table 6.

Sitodrepa.

Grain	No. of larvae	No. of adults	Period of emergence, days	No. of grains	No. undamaged	No. damaged	Type of damage
1. Undamaged . . .	20	14	51–66	100	86	14	Entire embryo eaten plus some endosperm. 1 grain per larva (except No. 2).
2. Undamaged larvae 2 wks. old	20	5	58–90	100	92	8	
3. Very slightly damaged .	20	12	47–62	100	88	12	
4. Slightly damaged . .	20	17	42–56	97	80	17	
5. Damaged	20	13	42–56				
6. Wholemeal . . .	20	14	34–44				

Most first stage larvae succeed in entering the germ. One larva enters one germ and eats it completely out without in the least touching the bran overlying the germ. Larvae a fortnight old are apparently less able to establish themselves inside an embryo than first stage larvae.

Ptinus tectus.

TABLE 7.

Ptinus.

Grain	No. of larvae	No. of adults	Period of emergence, days	No. of grains	No. undamaged	No. damaged	Type of damage	
							Embryos entirely removed and some adjoining endosperm	Grain superficially damaged
1. Undamaged	20	9	73–94	173	28	145	54	92
2. Undamaged larvae 2 wks. old	20	7	50–64	73	13	60	38	22
3. Very slightly damaged .	20	10	68–94	185	25	160	59	101
4. Slightly damaged . .	20	12	65–93	102	3	99	77	22
5. Damaged	20	14	60–89					
6. Wholemeal . . .	20	10	62–75					

Ptinus larvae grow on undamaged grain about as well as on grain damaged in varying degrees and on wholemeal flour. The mortality is in all cases fairly high.

Ephestia kühniella.

TABLE 8.

Ephestia kühniella.

Grain.	No. of larvae	No. of adults	Period of emergence, days	No. of grains	No. undamaged	No. damaged	Type of damage	
							Embryos entirely removed and some adjoining endosperm	Grain superficially damaged
1. Undamaged	20	3	50–80	358	333	25	17	8
2. Undamaged larvae 2 wks. old	20	12	45–73	102	38	64	52	12
3. Very slightly damaged .	20	7	54–68	360	306	54	48	6
4. Slightly damaged . .	20	16	39–63	101	22	79		
5. Damaged	20	15	37–52					
6. Wholemeal . . .	20	17	36–48					

The first stage larva of *Ephestia kühniella* apparently does not attack entirely undamaged grains. The three larvae out of 20 which survived may have struck grains which were slightly damaged. This is suggested by the progressively larger number of surviving larvae as the grain is more damaged. The 14-days old larva is much more successful on undamaged grain than the first stage larva.

From tables 3 to 8 the average damage done by one larva during the course of its development on grain has been calculated. The figures given in table 9 do not pretend to give more than an approximate indication of the kind of damage done by the different insects. An accurate result would be based on a greater number of individual insects, with a greater number of grains per insect, and breeding should be done in single cultures. It is not considered that overcrowding has been considerable in our experiments, except in the case of *Ptinus*. For the sake of completeness corresponding figures for *Ephestia kühniella* and *Ephestia elutella* are added, which were obtained from single cultures and with a larger number of grains available for each larva.

TABLE 9.

Insects	No. of larvae	Average number of grains damaged by 1 larva during development	
		Germ and adjoining parts eaten	Slight or superficial damage in other parts
Tribolium . . .	42	2·9	—
Silvanus . . .	14	1·7	—
Lasioderma . . .	38	1·8	1·0
Sitodrepa . . .	32	1·0	—
Ptinus	38	6·0	6·2
Ephestia kühniella . .	10	6·5	1·4
(Dr. O. W. Richards) .	16 ♂♂	15·0	8·0
	9 ♀♀	19·4	8·5
Ephestia elutella (Miss N. Waloff) . .	66	47·1	5·4

We are much indebted to Dr. O. W. Richards and Miss N. Waloff for permission to quote these figures from their unpublished work on *Ephestia kühniella* and *E. elutella* respectively.

Our own tests were done with five *Ephestia* larvae in a culture. On undamaged and very slightly damaged grain only one or two larvae developed in each tube, and the large number of grains which remain undamaged in some of the tests does not suggest overcrowding. The individual grains used by us were considerably larger than those used by Dr. Richards, and this may possibly account for the large difference in the result.

Ephestia elutella damages a very much larger number of grains per larva than *E. kühniella*, and this must be mainly attributed to the fact that the former only eats the embryos whereas the latter feeds on all parts of the grain.

The germ is the part of the grain which is chiefly attacked by all the insects under investigation. There are, however, characteristic differences in the type of destruction caused by different insects.

Tribolium confusum eats the germ neatly out and sometimes also eats parts of adjacent endosperm. The bran is not eaten, except for the section which covers the embryo, therefore the edges of the bran round the hollow which previously contained the embryo are sharp.

Silvanus enters the germ through a tiny hole at the tip of the germ and eats the germ out, leaving the overlying bran intact.

Lasioderma feeds on the germ and in addition eats parts of the endosperm. The damage is hardly ever confined to the germ alone. It also occasionally nibbles away small pieces in other parts of the grain. Pupation sometimes takes place inside the grain.

Sitodrepa enters the germ through a tiny hole at the tip (like *Silvanus*). It seems to feed at first on the embryo and then on the endosperm. Pupation takes place inside and the adult leaves the grain through a tunnel which may lead outside in any direction. The bran which covers the germ is never eaten and the only indication of the presence of a larva, or pupa, inside is the tiny hole by which the larva first entered. The development is therefore like that of an internal pest of grain such as *Calandra*, *Rhizopertha* or *Sitotroga*.

Ptinus eats the germ and parts of the bran surrounding it. In addition it nibbles away the bran alone over large areas. The endosperm is only a little attacked.

Ephestia kühniella feeds on the germ and on large parts of the grain often comprising over half a grain. The grains often become split up into smaller fragments. The damage is hardly ever confined to the embryo.

Ephestia elutella feeds exclusively on the germ. The destruction it causes is indistinguishable from that caused by *Tribolium*. The germ is neatly removed, leaving the sharp edges of the bran around the cavity. The endosperm is never attacked.

It is therefore clear that all the insects under investigation grow well on whole grain. Grain which is entirely undamaged is difficult to attack for young larvae of *Silvanus*, *Tribolium*, *Lasioderma*, *Sitodrepa* and *Ephestia*, whereas older larvae, with the exception of *Silvanus*, can attack them. In actual practice undamaged grain in the strict sense does not exist. The majority of grains show small lesions on the bran above the germ and it has been shown that all the insects enter the germ through such lesions. Apart from this there are always grossly damaged grains present together with a certain amount of dust. In fact, *Tribolium*, *Silvanus*, *Ptinus*, *Ephestia kühniella* and *elutella* although not being typical grain pests have from time to time been reported to have caused major destruction of grain, and this is confirmed by unpublished records of the survey of infestation of grain by insects (Munro 1940). According to Dendy (1918) *Tribolium castaneum* and *Silvanus surinamensis* are secondary grain pests, feeding upon the debris produced by the attack of other insects, notably the weevils. There is less printed evidence for *Lasioderma* and *Sitodrepa* as pests of stored grain. According to Back and Cotton (1940) *Lasioderma* occasionally attacks grain which has been stored in sacks for long periods. Zacher and Janisch (1923) report that *Sitodrepa* has occasionally been found to do major damage to grain. Cotton and Good (1937) state that *Sitodrepa* feeds on grain, but is not important as a pest on grain.

(4) *Growth on other dried foods.*

In addition to flour and grain a number of dried foods were given to the insects in order to discover their potential range of distribution and, if possible, to correlate with this their basic food requirements. The following foods were used :—

Dried debittered brewers yeast (Glaxo Laboratories). It has a high protein, vitamin and salt content, but possibly contains very little carbohydrates (*vide* table 10, note 5).

Fishmeal (a commercial sample). It is very rich in protein and fat but poor in carbohydrates.

Meatmeal (a commercial sample, probably manufactured by Brand's). It is rich in protein and poor in carbohydrates.

Dried milk. Full cream milk powder dried by the roller process in England in the middle of July 1941 (obtained from Glaxo Laboratories).

Pea flour (a proprietary brand). It has a composition not unlike that of grain, with a high carbohydrate and a fairly high protein content.

Cocoa (Bourneville).

Figs and currants as dried fruit.

Table 10 gives figures for the average composition of similar foodstuffs (mostly taken from McCance and Widdowson) and also of the water contents, determined in our own samples, in equilibrium with 70% relative humidity.

TABLE 10.

Chemical Composition of the Foods.

	Water content in equilibrium with 70% relative humidity, %.	Water content determined for chemical analysis, %.	Protein, %.	Carbohydrates, %.	Fat, %.	Ash, %.
Wholemeal flour [1]	14	15	15·3	68	3·1	—
Dried yeast [2]	15	9	46·6	(30·9) ?[5]	2·1	11·4
Fishmeal [2]	11·3	6·7	65·2	none [3]	6·1	16·5
Meatmeal [2]	8·2	6·6	61·4	none [3]	17·7	10·2
Dried milk [1]	6·5	1·3	26·4	38·8	29·7	—
Pea flour [1]	11·5	8·7	21·5	50	trace	—
Cocoa [1]	9·1	2·5	20·4	35·0	25·6	—
Currants [1]	—[4]	22·0	1·7	63·1	trace	—
Dried figs [1]	—[4]	16·8	3·6	52·9	trace	—

[1] Figures from McCance and Widdowson (1942).

[2] Analysed by Analytical Laboratory, Peek House, 20, Eastcheap, London, E.C. 3.

[3] "There is no evidence whatever of the presence of any added sugar or molasses." (Report of Analyst.)

[4] Very hygroscopic.

[5] Determined by "difference" (undetermined matters). Report of Analyst: "The sample contains no starch, and no added sugar of any kind. But acid hydrolysis yields a copper-reducing power equivalent to 23 per cent. of dextrose, so that the 30·9 per cent. of undetermined matters appears to be substantially composed of some form of carbohydrates. Included in this, of course, is a small quantity of matters insoluble in acid and alkali (*i.e.* 'Fibre')."

According to Silbereisen (1936) and Hind (1940) carbohydrates occur in the cell wall and the cell content of yeast mainly in the form of highly polymerised polysaccharides of the glycogen and mannan type, present as phosphoric acid or silica esters. On acid hydrolysis they yield glucose and mannose, but it is impossible to predict whether sugars would be set free in the course of normal digestion. Different insects may also differ in their ability to utilise these polysaccharides.

The results of the feeding experiments with the different insects on the various foods are given in figs. 12 to 16. In all cases first stage larvae were placed on the food and the time until pupation (*Tribolium*) or emergence of the adult (other insects) was determined. No such curves are given for *Ephestia kühniella* and *E. elutella* which for reasons not yet determined proved unsatisfactory on every food except flour. Table 11 gives a somewhat simplified summary of all the feeding tests. The performance on wholemeal flour has been indicated everywhere as ++++ and the relative efficiency of the foods is shown by a greater or smaller number of + signs. ± indicates that some growth has taken place and that one or two specimens may have completed development after long delay.

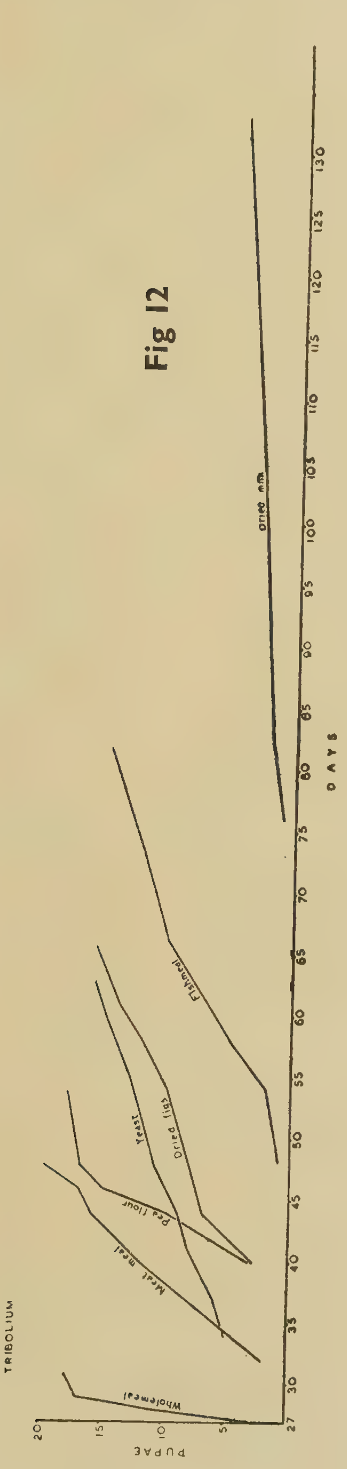

Fig 12

FIG. 12.—Growth of *Tribolium confusum* on different dried foods.

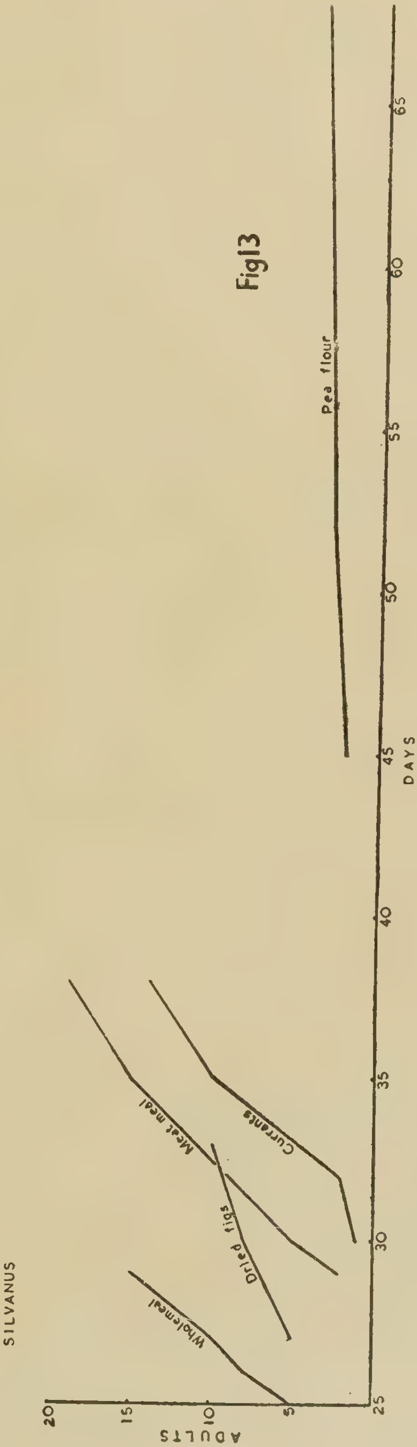

Fig13

FIG. 13.—Growth of *Silvanus surinamensis* on different dried foods.

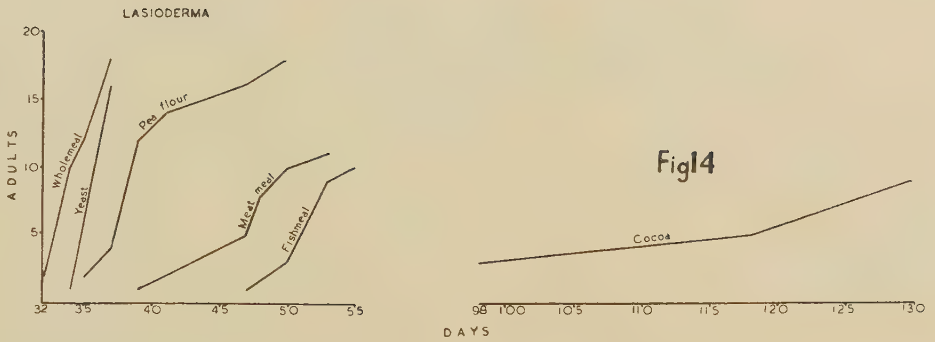

FIG. 14.—Growth of *Lasioderma serricorne* on different dried foods.

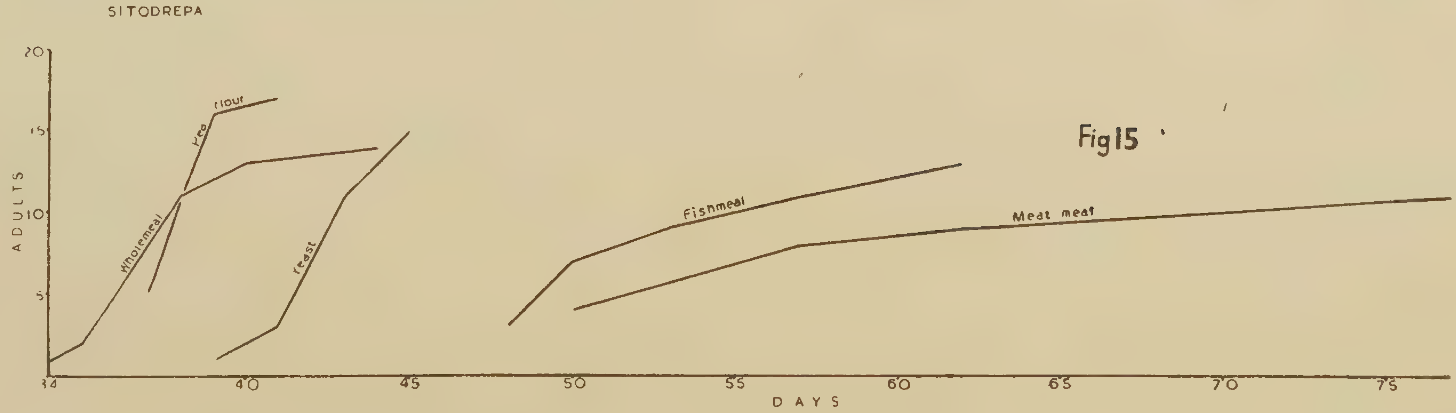

FIG. 15.—Growth of *Sitodrepa panicea* on different dried foods.

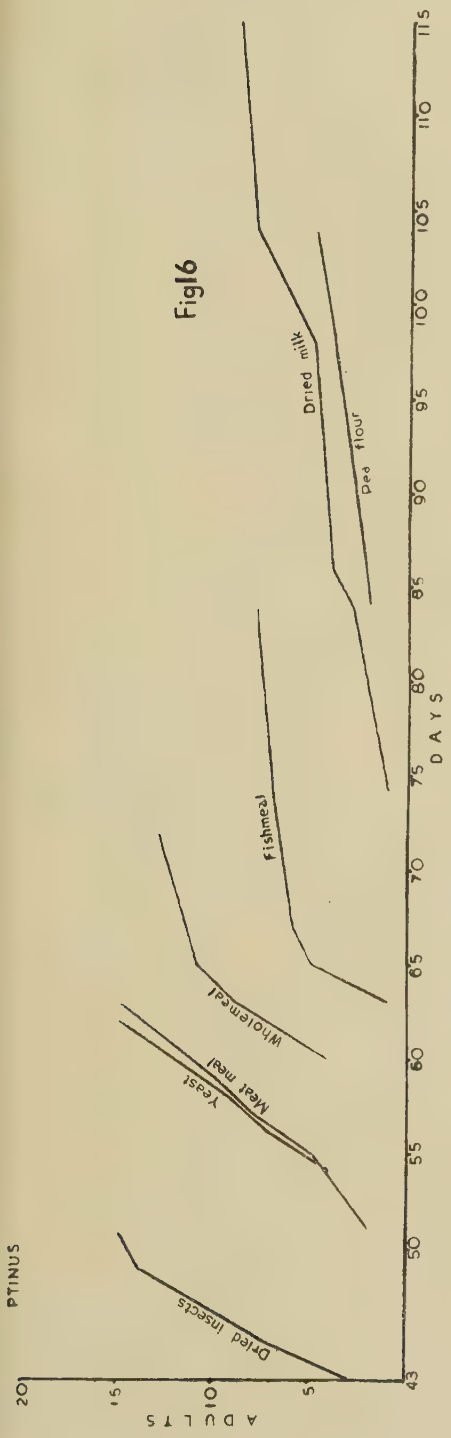

FIG. 16.—Growth of *Ptinus tectus* on different dried foods.

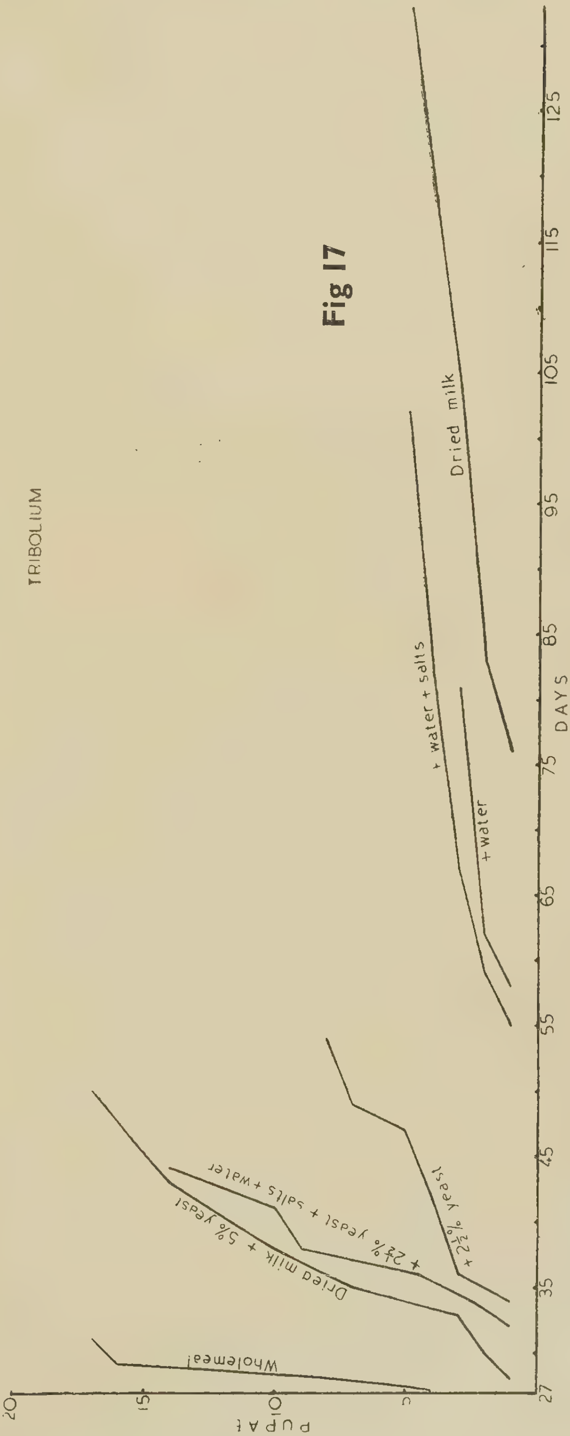

FIG. 17.—Growth of *Tribolium confusum* on dried milk alone, and in combination with yeast, salt and water.

TABLE 11.

	Tribolium	*Silvanus*	*Lasioderma*	*Sitodrepa*	*Ptinus*	*Ephestia kühniella*	*Ephestia elutella*
100% flour .	++++	++++	++++	++++	++++	++++	++++
85% flour .	++++	++++	++++	++++	++++	++++	++++
73% flour .	+++	+++	+++	++	+	++	±
40% flour .	++	++	++	+	±	+	–
Middlings . .					+++		+++++
Bran . . .					+++++		
Wheat germ .					++++		++++++
Dried yeast .	++(+)		++++	+++	+++++	–	–
Fishmeal . .	+		++	++	+++	–	–
Meatmeal . .	+++	(+++ ?)	++	+(+)	+++++	–	±
Dried insects .					+++++++		
Dried milk . .	±	–	–	–	++	–	–
Pea flour . .	+++	±	+++	++++	+	–	–
Cocoa . .	–	–	+	±	±	–	–
Currants . .	–	+++	–	–	–	±	±
Dried figs . .	++(+)	+++	–	–	±	–	+

While most of the deductions from these experiments will be discussed in the following section " Conclusions ", some explanatory notes on the peculiarities of some of the foods as breeding media for insects follow here :—

Meatmeal : *Silvanus*, an insect which requires carbohydrates in the diet, grew unexpectedly well on meatmeal. The origin and method of preparation of this meal was not known and from the result given by *Silvanus* it was suspected that it might contain additions of a material rich in carbohydrates (possibly molasses). Analysis of this meatmeal showed, however, no evidence for the presence of carbohydrates (Table 10, note 3). On the other hand, *Silvanus* did not grow on home-made meatmeal, prepared from fresh meat. We cannot explain the discrepancy between these results.

Cocoa proved an inadequate food for all the insects tested. *Ptinus* and *Lasioderma* alone grew very slowly on it and a few larvae completed development after long delay. This result is in agreement with the experiences of the cocoa manufacturers according to whom manufactured cocoa, as distinct from cacao beans, is not liable to insect attack. The causes of this difference are so far unexplained, but it must be remembered that during manufacture cacao goes through a process of roasting and peeling and that most of the fat is removed.

The breeding of most of the insects on dried fruit was unsatisfactory, probably because at 25° C. and 70% R.H. the fruit became moist, sticky and often fermented. *Silvanus surinamensis* grew well on currants and dates, and *Tribolium* grew well on dates, but *Ephestia elutella*, *Sitodrepa*, *Lasioderma* and *Ptinus* did not develop on dried fruit in our cultures. This lack of success was at first attributed to faulty methods of breeding, since all these insects have been reported to infest dried fruit. It is interesting to compare our experiences with those of the dried fruit trade. I am much indebted to Mr. C. Rainbird of the Australian Dried Fruits Board for the following information on the occurrence of the insects concerned in ships and warehouses :—

Ephestia elutella : All dried vine and citrus fruits, dates and figs.

Silvanus surinamensis : Well established on Smyrna sultanas and figs, latterly on Californian raisins and Iraq dates.

Lasioderma serricorne : Not so far found established ; isolated adults only.

Sitodrepa panicea : Not so far found established.

Ptinus tectus and *P. fur :* Light but widespread external infestation on all Australian dried fruits at Millwall prior to the war. Rarely found feeding on fruits ; thought to have been feeding on decaying organic matter (old dead infestation) in the fabric. Isolated adults found on Australian fruits in outports.

Tribolium confusum: Well established on Smyrna sultanas, Californian raisins, and Iraq dates.

It will be seen that, with the exception of *Ephestia elutella*, these experiences agree well with ours, as summarised in table 11.

Dried milk was a very unsatisfactory diet for all the insects except *Ptinus*. With insects which do not require carbohydrates this was somewhat unexpected, because synthetic diets which consist mainly of casein support development of our insects very well and milk is usually regarded as a complete food (with the exception of a deficiency in iron). The carbohydrate in milk, lactose, is not utilised by the insects concerned (unpublished results) and we should therefore not expect the insects which need carbohydrate, *Silvanus*, *Sitodrepa* and *Ephestia kühniella*, to grow on dried milk. Dried milk has a very low water content, about 6%, which is probably due to its high fat content of about 30%. This low water content certainly acts unfavourably on the growth of insects. Adding water to dried milk or adding water and salts noticeably speeded up the development of *Tribolium*, but the mortality still remained high (fig. 17). Diets in which water was added proved on the whole very unsatisfactory because they became heavily infested by moulds.

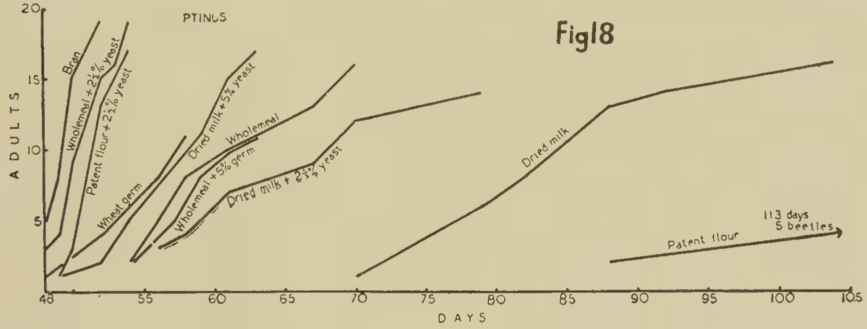

FIG. 18.—Growth of *Ptinus tectus* on wholemeal flour, germ, bran, and on flour or dried milk in combination with yeast or germ.

Addition of 2½% dried yeast effected a startling improvement of the diet for *Tribolium*, which was still further enhanced by adding salts and water. (This diet did not become mouldy.) With 5% yeast, but without water and salts, the diet became still better, and was noticeably better than yeast alone (fig. 17).

A similar result was obtained with *Ptinus* (fig. 18). Adding 2½% dried yeast to dried milk speeded up its development very considerably, and with 5% yeast the diet was even more efficient than wholemeal flour, although not as efficient as bran. This remaining deficiency of dried milk plus yeast may be due to the low water content of the diet.

It appears therefore that the deficiency of dried milk as a food for insects is partly due to its low water content. But the more important factor is a lack of something which is supplied by dried yeast. 2·5% dried yeast in the diet hardly raises its water content yet improves the diet enormously. The most probable explanation is that it supplies some factor(s) of the vitamin B complex in which dried milk is deficient. The content of roller dried whole milk of B_1 and riboflavin has recently been determined (Kon 1941). 100 g. of dried milk contain 80 I.U. of B_1 and 0·8–1·6 mg. (according to season) of riboflavin. 1 I.U. B_1 being equal to 3·33 μg., dried milk contains 2·66 μg. per gram. According to Fräbrich (1939) *Tribolium* requires 4 μg. B_1 per g. dry food which would suggest the B_1 content of dried milk to be rather low for *Tribolium*. The riboflavin requirements of *Tribolium* are about 2·5 μg. per g. dry food (Fraenkel and Blewett 1943d). Dried milk with about 10 μg./g. riboflavin therefore contains this vitamin in abundance for *Tribolium*.

CONCLUSIONS.

In the following section an attempt is made to connect and combine all present knowledge of the food and feeding habits of the insects concerned, taking into account as well data on the dietetic requirements derived from experimental work and experience of the damage caused by these insects in stored foods.

Tribolium confusum is known in practically all parts of the world as one of the most destructive pests of flour and of all other kinds of cereal products. In addition it has been reported from a great variety of dry foodstuffs such as nuts, beans, peas, cacao beans, spices, yeast, meatmeal. The predilection of the flour beetle for flour and other milling products has somewhat distracted attention from the fact that it is also an important pest on grain. This " success " of *Tribolium* is based on several features of its dietetic requirements. It thrives well on a diet with no carbohydrates, although their presence is an advantage. On high-extraction flour the larval period is 27 to 30 days, while on foods poor in carbohydrates, such as meatmeal or yeast, the corresponding figures are 32 to 50 days and more. It can live equally well on food of vegetable and animal origin. It can grow on food with a water content as low as about 6%, *e.g.* on wholemeal flour in equilibrium with 12½% R.H., and on dried milk plus 2·5% yeast. Increasing the moisture content speeds up its development, but it appears that above a certain water content *Tribolium* is unable to live. This is suggested from the negative results obtained on a diet containing large quantities of the hygroscopic sugar fructose. From this, and also taking into consideration the low vitamin-B content of dried fruit, one would not expect dried fruits to be an adequate food for *Tribolium*. In practice, however, as stated above (Rainbird 1942) and confirmed by our results with figs, *Tribolium* infests dried fruit. It would be interesting to define the conditions under which dried fruit becomes an adequate food for *Tribolium*.

One special feature in the dietetics of *Tribolium* is its need for vitamins of the B-group. We have shown elsewhere (1943d) that of these, B_1, riboflavin, nicotinic acid, B_6, pantothenic acid, choline and biotin are essential food factors, while two more, inositol and *p*-amino-benzoic acid, are probably of some importance as well. The deficiency of patent flour, as compared with wholemeal flour, is almost entirely due to a deficiency in riboflavin (Fraenkel and Blewett 1941), while a deficiency of nicotinic acid has been demonstrated in a different sample of patent flour by Barton-Wright (1941). In whole grain *Tribolium* feeds preferably on the germ, which is the part richest in B-vitamins. The fact that dried milk, an unfavourable food for *Tribolium*, can be greatly improved by addition of 2·5% yeast, again makes it likely that this deficiency is primarily due to a lack in one or several factors of the B complex. Our knowledge of the amounts of the nine known B-factors in various dried foods is still much too incomplete for any correlation to be possible between relative value of foods and their content of one or more essential factors of the B complex. But it should be kept in mind that deficiency of only one vitamin would always constitute a limiting factor.

The question of whether *Tribolium* is a primary or secondary pest on grain has been much discussed. Most authors (*e.g.* Cotton and Good 1937, Zacher 1933) consider it to be a secondary pest. Dendy (1918) has shown that it cannot attack entirely undamaged grains. While fully confirming this statement, we established beyond doubt that the *Tribolium* larva successfully attacks grains which have only microscopically small lesions in the bran overlying the germ. The majority of grains are, in this sense, damaged, and theoretically, judging from our tests, *Tribolium* could be a pest of grain. In fact *Tribolium* has on many occasions been reported to have caused major damage to grain in store. The damage it causes is mostly confined to the germ, but adjacent parts of the endosperm are eaten as well. This agrees with the fact that *Tribolium* grows quite well on patent flour, although very much better on flour of higher extraction.

Silvanus surinamensis is chiefly known as a pest on two main types of food : (a) flour, grain and all kinds of cereal products, and (b) dried fruit. Its distribution and limitation seems to be chiefly determined by its not being able to grow on a food which contains little or no carbohydrates. This excludes fishmeal, meatmeal, and yeast. But, unexpectedly, *Silvanus* grew well on a meatmeal which, as shown by analysis (p. 474), contained little or no carbohydrates, while it failed to grow on a sample of " home-made " meatmeal. The discrepancy in these results is still unexplained. Dried milk, in spite of its high carbohydrate content, is an unsuitable food for *Silvanus*, probably because it cannot utilise lactose. It grows well on synthetic diets if the carbohydrate is glucose, maltose, fructose or starch, but not if it is lactose (unpublished). From all our knowledge of the dietetics of *Silvanus* one would have expected it to grow very well on pea flour, which has a high carbohydrate and a relatively high protein content. We cannot explain why pea flour is not an adequate food for *Silvanus*. It was at first thought that the particular sample used, a commercial brand, might have contained some unfavourable substance. But a negative result was subsequently obtained with dried peas ground to a powder. Peas seem to contain a substance which is poisonous to *Silvanus* (possibly the alkaloid trigonelline).

As a pest on whole grain *Silvanus* has several features in common with *Tribolium*. It does not attack entirely undamaged grains but attacks successfully grains which have small lesions in the bran covering the germ. In most cases the germ is the only part of the grain eaten, but sometimes *Silvanus* becomes established in the endosperm of an already damaged grain and then completes its development entirely on endosperm. This agrees well with the fact that patent flour, although not as favourable a food as flours of higher extraction, is still a fairly good food for *Silvanus*.

Silvanus is chiefly known as a pest on dried fruit and in our cultures it grew relatively well on currants and figs. Of the insects tested, *Silvanus* alone grows very well on a synthetic food (Table 1) which contains fructose as the sole carbohydrate. Fructose is the principal constituent of the sugar of fruits. A diet containing 50% fructose has a much higher water content (about 20%) than when starch or glucose is used (about 12%). *Silvanus* seems to be better fitted than other dried food insects to live on a diet with the relatively high water content, about 20%, of dried fruit, and this well explains its record as one of the principal pests of dried fruit.

Dried fruit is probably a relatively poor source of vitamins of the B-group, which suggests that the requirements of *Silvanus* in these vitamins cannot be great. In fact *Silvanus* grows relatively better than other insects on patent flour, another poor source of B-vitamins. Experiments of a different nature also demonstrated the low requirements of *Silvanus* for some B-factors (1943d). A diet was devised which consisted of casein, glucose, cholesterol, salts, insoluble residue of yeast and all the known B-vitamins in pure substance. In a series of tests the nine B-vitamins were omitted one at a time from the diet. For *Tribolium* omission of one of the important vitamins, namely B_1, riboflavin, nicotinic acid, B_6, pantothenic acid had a profound negative effect on growth. For *Silvanus* the diet became only little less favourable when B_1 or B_6 was omitted, and even without riboflavin many completed development. *Silvanus* is obviously relatively less dependent on the external supply of some B-factors than *Tribolium* or, as we shall see later, *Ptinus*. This difference is explained by the presence, in *Silvanus*, of intracellular " symbionts " in " mycetomes " which are embedded in the fat body.

Lasioderma serricorne has been reported as a pest from a great variety of dried foods, such as flour and other milling products, dried fruit, dried plants, spices, starch, yeast, nuts, dried fish, cacao beans (Runner 1919). As it is an insect of warm climates it usually does not cause damage on a large scale in temperate climates, except in tobacco where infestation starts in the hot countries of its origin, and damage is caused only during the hot season. Its omnivorous habits can again be explained to a certain extent by analysing the basal food requirements. *Lasioderma* like *Tribolium* grows well on a diet without carbohydrates. In our experiments it grew well on the carbohydrate-poor foods, yeast, fishmeal, meatmeal. It is equally successful on food of animal or vegetable origin. In its requirements of vitamins of the B-group it resembles *Silvanus* in as much that it is independent of the supply of certain vitamins, presumably by virtue of the presence of intracellular yeasts in the caeca of the gut. In experiments on a synthetic diet, in which all the B-vitamins were supplied in pure substance, *Lasioderma* maintained excellent growth in the absence of some of the more vitally important vitamins B_1, B_6, riboflavin and nicotinic acid. This astonishing independence of external vitamin supplies possibly explains its successful growth on a " food " as poor as manufactured tobacco. To the best of our knowledge the food qualities of tobacco have never been investigated, but from its treatment after harvesting it can be assumed that the carbohydrate content must be practically nil and that the content of B-vitamins must be very low. Manufactured cocoa, again a food poor in vitamins, proved a better food for *Lasioderma* than for any other of the insects tried by us, although growth was exceedingly slow. *Lasioderma* did not grow in our cultures on dried fruit, which agrees with the lack of success on a fructose-diet. It is reported in the literature as a pest of dried fruit, but this is not the opinion of experts of the Australian Dried Fruits Board (p. 478). *Lasioderma* grows well on dead insects and this is possibly the explanation of its occurrence in dried fruit (*vide* postscript p. 488).

Sitodrepa panicea is, as its name indicates, chiefly known as a pest on dry bread and other bakery products. Janisch (1923) says that it chiefly occurs on dry foods which are rich in starch, like dry bread, biscuits, cake, noodles, flour, desiccated soups, grain and cereal products. This agrees well with our observation that *Sitodrepa* must have carbohydrates in the diet. However, in this respect, it is not as particular as *Silvanus*, which does not grow at all without carbohydrates. On a synthetic diet without carbohydrates 6 animals out of 20 reached the adult stage. From this it appears that *Sitodrepa* only requires small quantities of carbohydrates. *Sitodrepa* has been occasionally found on practically every kind of organic matter such as dried plants in herbariums, dried insects in collections, cork, old books, drugs and spices (hence the American common name, " drug store beetle "), tea, coffee, cacao, dried meat, dried figs, etc. Although some of these records are doubtless wrong and may apply to the beetle and not the larva, it seems that a low carbohydrate content does not necessarily prevent *Sitodrepa* from developing. This agrees with our own tests, where of the carbohydrate-poor foods yeast was remarkably successful, and fishmeal and meatmeal better than expected. Development, however, is still much quicker on wholemeal flour. The possibility is not excluded that *Sitodrepa* can utilise the highly polymerised carbohydrates of yeast (*vide* table 10, note 5). In whole grain *Sitodrepa* feeds on the germ and adjacent parts of the endosperm. With regard to its requirements of vitamins of the B-group, *Sitodrepa* to a certain extent resembles *Lasioderma* inasmuch as it has become independent of external supplies of some of the factors, probably by virtue of harbouring intracellular yeasts. Koch (1933) demonstrated that larvae bred from eggs, which had been sterilised so that the larvae had no symbionts, grow very slowly, but grow normally if yeast or wheat germ is added to the food. It appears from our tests that *Sitodrepa* can develop quite well in the absence of some of the more important vitamins, nicotinic acid, riboflavin and B_6. This independence of vitamins in the diets is possibly the explanation for its attack on some of the very poor food substances enumerated above like tea, cork, dried plants (*vide* postscript p. 488).

With regard to dried fruit the position is similar to *Lasioderma*. *Sitodrepa* did not grow in our tests on currants and figs, nor on a fructose-diet. It has not been found as a pest on Australian dried fruits (Rainbird 1942). Records in the literature of infestation of dried fruit by *Sitodrepa* may be untrustworthy.

Ptinus tectus is known as a pest on a great variety of foods such as grain and cereal products, casein, yeast, nuts, dried fruit, fishmeal, meatmeal, whalemeal, etc. These omnivorous habits are partly explained by the fact that *Ptinus* grows well on a diet entirely lacking in carbohydrates. In fact, in contrast to the other beetles we have so far dealt with, there is no indication that presence of carbohydrates is of any advantage to *Ptinus*. In our tests *Ptinus* grew remarkably better on dried insects, which contain little or no carbohydrates, than on any other food, and grew better on the carbohydrate-poor foods, yeast and meatmeal, than on wholemeal flour.

Ptinus seems to have a particular predilection for foods of animal origin, and seems to thrive well on foods with a high fat content. In commerce some of the most serious damage by *Ptinus* has been reported in stored whalemeal. In our laboratory it has, on several occasions, caused great destruction of dried insect specimens and it commonly breeds on dead flies in a fly culture. This makes it likely that its occurrence on some of the foods reported above may be chiefly due to the presence of dead insects. Dried insects usually contain 40–50% of fat. Another food of animal origin and of a high fat content (30%) is dried milk on which *Ptinus* grew relatively better than the other beetles we have tested. The deficiency of dried milk for *Ptinus* is, as we have shown above (p. 479), due to a lack of vitamins of the B-group and probably to its low water content.

The requirements of *Ptinus* for vitamins of the B-group are high and closely similar to those of *Tribolium*. These two insects differ from *Silvanus*, *Lasioderma* and *Sitodrepa* in not harbouring intracellular symbionts and grow very slowly, or not at all, in the absence of B_1, riboflavin, nicotinic acid, B_6, pantothenic acid, biotin and choline. Of the beetles concerned, *Ptinus* alone grows better on several other foods than on wholemeal flour. This deficiency of flour is probably entirely due to a lack of vitamins of the B-group. By adding $2\frac{1}{2}\%$ yeast to wholemeal flour growth is speeded up enormously (fig. 18). Even patent flour, a totally insufficient food, is brought to about the same efficiency by adding $2\frac{1}{2}\%$ of yeast (fig. 18). Hardly any substances other than vitamins could be expected to produce such striking effects when added in such dilution. Wholemeal flour plus yeast is of approximately the same efficiency as bran, and the high efficiency of bran, compared with wholemeal flour, must again be attributed to its higher content of B-vitamins. From this, germ would have been expected to show at least the same efficiency as bran. However, in one experiment (fig. 5) germ was noticeably inferior to even wholemeal flour, and in another test the mortality on germ proved high (fig. 18). Two different samples of germ, one ground and another in flakes as produced in milling, gave about the same results. From this it appears that undiluted germ is either lacking in some other constituent, or, more likely, exerts some unfavourable effect. Added in small quantities (5%) to flour, germ had not the expected improving effect (fig. 18). Middlings and wheatings are fractions removed in the manufacture of white flour and are therefore expected to contain a higher concentration of B-vitamins than wholemeal flour. From this one would expect the nutritional value of these milling fractions on *Ptinus* to be higher than that of wholemeal and similar to that of bran. We cannot explain why this was not the case (fig. 5).

On whole grain *Ptinus* can be very destructive, feeding particularly on the embryo, and in addition on the bran. The latter, including the aleurone layer which is rich in B-vitamins, is frequently eaten off the endosperm over large areas of the surface. Endosperm is only little eaten, which agrees with the fact that low extraction flour, which practically consists of endosperm, is a very unfavourable food. The predilection for bran is interesting in view of the excellent results obtained on bran as a food.

It is therefore clear that *Ptinus* requires relatively larger amounts of B-vitamins than the other insects investigated by us. On a synthetic diet *Ptinus* requires at least 7 factors of the B complex; on whole grain the germ and bran, the parts richest in vitamins, are chiefly eaten; not only white flour, as with other insects, but even wholemeal flour is deficient in B-vitamins, and part of the deficiency of dried milk can be attributed to the same cause.

It is still unexplained why *Ptinus* grew badly on pea flour and the cause for this is more likely to be a toxic effect than a dietary deficiency. *Ptinus* has frequently been found associated with dried fruit and is often regarded as a serious pest of this commodity. In our cultures it failed to grow on figs or currants, or on a fructose-diet. From the experience of those who handle dried fruit commercially (Rainbird 1942) and from what we know now about the dietetics of *Ptinus*, it is likely that its occurrence on dried fruit is due to its feeding on the remnants of dead insects which primarily infest it.

We had little success in our attempts at breeding the two moths, *Ephestia elutella* and *kühniella*, on foods other than grain and flour. This was to be expected with *E. kühniella*, which has never been reliably reported from any other food than cereals. We have also not yet succeeded in breeding *E. kühniella* satisfactorily on synthetic diets, but it has been established in these attempts that it requires carbohydrates, which one would have expected. With regard to *E. elutella* our lack of success on food other than cereals is less excusable. *E. elutella* is remarkable for breeding on and heavily damaging foods of such a diverse nature as dried fruit, tobacco, cacao beans and grain. It has been the experience of this laboratory for many years that *E. elutella* grew very unsatisfactorily in the laboratory on dried fruit, and still worse on cacao beans and tobacco. An explanation of the behaviour of *E. elutella* in the laboratory is likely to shed some light on what constitute optimal conditions for outbreaks of *elutella* in warehouses.

The difference between the two *Ephestia* species on flour of different extraction and on whole grain has already been commented upon. *E. kühniella* grows even on low extraction flour, and in accordance with this feeds indiscriminately on germ and endosperm in whole grain. *E. elutella* does not grow on low extraction flour and on grain strictly avoids feeding on any other part than the germ. This would seem to suggest that the requirements of *E. kühniella* for B-vitamins are low, and for *E. elutella* high, which is certainly not borne out by what else is known of the feeding habits of *elutella*. From the outcome of laboratory experiments one would expect both species to be common pests on grain in store. *E. kühniella*, the most destructive pest in flour mills, has sometimes but not often been reported to cause damage on grain (Zacher and Janisch 1923). *Ephestia elutella* has only rarely been reported from grain in storage, as for example in England during the last war (Dendy and Elkington 1919) (*vide* postscript p. 488).

The insects which have been dealt with in this paper have been chosen on account of their being common pests on flour. By way of contrast some details about the requirements of another food pest, *Dermestes vulpinus*, may be mentioned here. *Dermestes* is normally found on dried food of animal origin such as meatmeal, fishmeal, bacon, hides, dried milk. Like other insects it requires a sterol in the food, but unlike the other insects investigated by us it only grows if the sterol is cholesterol (Fraenkel, Reid and Blewett, 1941). It does not grow on sitosterol, or ergosterol, or calciferol (vitamin D_2). Cholesterol is the typical sterol of animal origin, sitosterol occurs in plants, and ergosterol in fungi and bacteria. For example, *Dermestes* does not grow on yeast (which contains ergosterol) alone, but grows well when 1% cholesterol is added. *Dermestes* has sometimes been reported as a pest of copra, which presumably contains sitosterol. We did not succeed in breeding *Dermestes* on copra, and it seems very likely that it grows on the dead bodies of the other insects by which copra is usually infested. *Dermestes*, then, is restricted to food of animal origin by its requirements for the animal sterol cholesterol. The flour insects, dealt with in this paper, grow equally well on the three natural sterols, cholesterol, sitosterol and ergosterol, and in accordance with this they infest food of animal *and* vegetable origin, including the lower plants. A sterol is not the limiting factor in their distribution.

This attempt at finding a correlation between food requirements of certain store pest insects and their food habits has brought out certain inconsistencies for which explanations are still missing, *e.g.* the failure of *Silvanus* and *Ptinus* to grow on pea flour, the failure to grow *E. kühniella* on synthetic diets and the failure of *T. confusum* to grow on a fructose-diet while growing quite well on dried fruit. So far the relations between insects and their food have been investigated rather one-sidedly from the point of view of dietetics. It is of course obvious that dietetics cannot explain everything. It is true that no insect can develop on a food which is lacking even in one important constituent. On the other hand, there are a variety of factors other than strictly nutritional ones which may explain why a particular food is not suitable, or why an insect may be a pest in a warehouse but fails to grow under laboratory conditions. Some of the factors hitherto not considered in this paper should be mentioned here :—

1. We have dealt with several factors which, if operating *singly*, may decide the suitability of a food : vitamin content, water content, carbohydrate content, and sterol content. In many cases more than one factor may be acting adversely at the same time : dried milk, for example, may be too dry for *Ptinus* and may also be lacking in certain vitamins. Dried fruit may often be too moist for *Tribolium* and may also be lacking in some vitamins.

2. Certain physical factors concerning texture or mode of presentation of the food are of importance. If the food is not homogeneous, *e.g.* wholemeal flour, insects may be able to pick out what suits them and the food would then appear better than one would expect from its chemical composition. Undamaged grain is not suitable for some insects but becomes suitable if there are slight lesions in the bran. Hardness, stickiness, and particle size may also be important factors.

3. The taste and smell of the food is probably of great importance although our knowledge in this respect is almost nil. *Tribolium* and *Ephestia elutella* have been shown in olfactometer experiments to be attracted by the smell of flour (unpublished experiments in this laboratory). It may well be that an otherwise adequate food is not taken on account of the absence of adequate sensory stimuli, or the presence of repellent stimuli. Such may be the reason for failure of *Silvanus* and *Ptinus* to grow on pea flour.

4. We do not always know the optimal conditions for breeding. The conditions at a constant temperature and humidity of 25° C. and 70% respectively may not always have proved optimal. The failure in the laboratory to breed on dried fruit insects which in warehouses are pests of dried fruit comes under this heading. It is difficult, in laboratory cultures, to prevent dried fruit from becoming sticky and moist. *Ephestia elutella* has proved an insect exceedingly difficult to breed on dried fruit, tobacco, or cacao in the laboratory.

5. The ability to withstand adverse conditions for long periods may decide the success of an insect as a pest. On a moderately adequate food development is slow. Under controlled conditions in the laboratory an experiment often cannot be carried through to the end because cultures may after a long time become infested by mites, or fungi, or other accidents may occur. In a warehouse extremely slow development may be no ultimate hindrance to the insect becoming a pest, provided it can survive extreme unfavourable conditions such as cold winters. For *Lasioderma* the temperature in Great Britain is probably too low for it to become a pest, although it grows in the laboratory on a great variety of different foods. Mansbridge (1936) investigated for a number of stored products insects whether and in which stage they can survive the winter in an unheated building. Of the insects dealt with in this paper, *Tribolium confusum* did not survive the winter, *Silvanus* nearly survived a severe winter and will probably survive an average winter. *Sitodrepa* did not survive a severe winter but survived an average one. *Ptinus*, *Ephestia kühniella* and *elutella* survived a severe winter. It is therefore possible that under unfavourable conditions *Silvanus*, *Sitodrepa*, *Ptinus* or *Ephestia elutella* may grow very slowly and still manage to reach a stage in which damage is done on a large scale.

6. In this paper only larval growth has been taken into consideration. The conditions for larval growth are the most exacting ones in a nutritional

study, but they are not the only ones to decide whether an insect can become a pest of a particular food. The food must be at the same time an adequate breeding medium for the adult. It has to provide the nutrients essential for the adult to form eggs and the stimuli necessary for the adult to lay them. *Silvanus* lays only very few eggs on white flour and many more if some yeast or wheat germ is added to it. *Ptinus* lays more eggs on fishmeal than on flour. Its egg production is also increased by the provision of potable water.

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SUMMARY.

1. The dietary requirements of several common stored products insects have been analysed with a view to correlating the food requirements and the natural foods of these insects.

2. The following four main factors have been recognised as of importance in the nutrition of insects: (1) requirements of carbohydrates, (2) quantitative and qualitative requirements of sterols, (3) moisture content of the food, and (4) qualitative and quantitative requirements of vitamins of the B-group.

3. Flour becomes an inferior food with increasing extraction. On low-extraction flour *Tribolium*, *Lasioderma*, and *E. kühniella* grow relatively better than *Sitodrepa*, *Ptinus* and *E. elutella*.

4. When bred on flour in equilibrium with different relative humidities and therefore with different moisture content, the insects grow better at a high than at a low humidity, but show quantitative differences in their reactions. *Tribolium*, *Silvanus* and *E. kühniella* still grow fairly well at about 6% water content, and *E. kühniella* even at 1%, whereas *Lasioderma*, *Sitodrepa* and *Ptinus* do not grow below 10%.

5. Grain, as it occurs in storage, usually has small lesions in the bran, and all the insects grow well on such grain. Newly hatched larvae of some insects cannot grow on entirely undamaged grain, but older larvae of these insects may do so. They feed chiefly in the germ region, but show characteristic differences in their methods of attacking grains and causing damage. These differences have been described.

6. It has been attempted to breed the insects on a number of characteristic types of dried foods, including yeast, fishmeal, meatmeal, pea flour, dried fruits, dried milk and cocoa.

7. As a result of the investigations, which are published elsewhere, into the basic food requirements of these insects and their reaction to flours of different extraction and moisture content, to whole grain and a number of widely different other dried foods, a connected picture of the food requirements and food habits of each insect has been given.

POSTSCRIPT, ADDED 24TH NOVEMBER, 1943.

1. *Utilisation of metabolic water in insects. Tribolium confusum, Dermestes vulpinus* and *Ephestia kühniella* acquire a substantial, or, at extremely low humidities, the greater part of the water ultimately found in the body by oxidation of food. At low humidities more food is eaten to produce a given unit body weight than at high humidities, and this is taken as an indication that part of the food is then utilised as water. With *Dermestes* at 30% R.H., less than 33%, and in the extreme case of *Ephestia kühniella* at 1% R.H. (over P_2O_5) less than 7·6%, of the water in the pupa can be derived from water ingested with the food (Fraenkel and Blewett 1943f).

2. *Intracellular symbionts as a source of vitamins.* The vitamin requirements of *Lasioderma serricorne* and *Sitodrepa panicea*, when grown free of symbionts, resemble in every respect those of insects which have no intracellular symbionts, e.g. *Tribolium confusum, Ptinus tectus* and *Ephestia elutella.* Unlike normal larvae, sterilised larvae fail to grow in the absence of B_1, riboflavin, nicotinic acid, B_6, pantothenic acid and choline chloride. All the important vitamins of the B-group are therefore normally supplied by the symbionts.

3. *Dietetics of Ephestia elutella.* The requirements of B-vitamins of *Ephestia elutella* closely resemble those of *Ptinus* and *Tribolium.* No growth is possible in the absence of B_1, riboflavin, nicotinic acid, B_6 or pantothenic acid. In addition, *Ephestia elutella* requires a fat soluble factor, contained in wheat germ oil, which is an unsaturated fatty linoleic acid. *Ephestia elutella*, unlike *E. kühniella*, grows well on artificial diets which contain glucose as the carbohydrate, and some growth occurs even in the absence of carbohydrates. This latter fact explains to a certain extent the omnivorous food habits of *Ephestia elutella.* For reasons still unexplained, *Ephestia elutella* cannot grow on artificial diets containing starch as the carbohydrate. This, and the lack of vitamins of the B-group, possibly accounts for its failure to grow on flours of low extraction.

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